POPULAR MECHANICS

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Long Key Concrete Viaduct--Completed

GREAT OCEAN RAILWAY, FLORIDA TO KEY WEST

Task Now Being Finished by the Hands of Men Commenced Centuries Ago by Billions of Coral Insects—By Its Completion Cuba is Brought 100 Miles Closer to United States, and Key West Becomes Great Sea Port

Thousands of years ago billions of infinitesimal coral insects commenced to build, cell upon cell, the coral formation which, rising above the ocean's surface, constitutes 50 or more small islands, known as the Florida Keys.

In the year 1905, centuries after the first army of coral-insect workmen commenced this task, a few thousand men, under the leadership of competent engineers, swooped down upon the more diminutive although infinitely more numerous army of builders, to complete the work commenced so long before, with concrete and other up-to-date construction material, so that the glistening steel rails of a great ocean railway could bind Florida's mainland to Key West.

Today, after a little over two years of incessant labor, 100 of the 156 miles

Right of Way Cleared—Workmen's Quarters

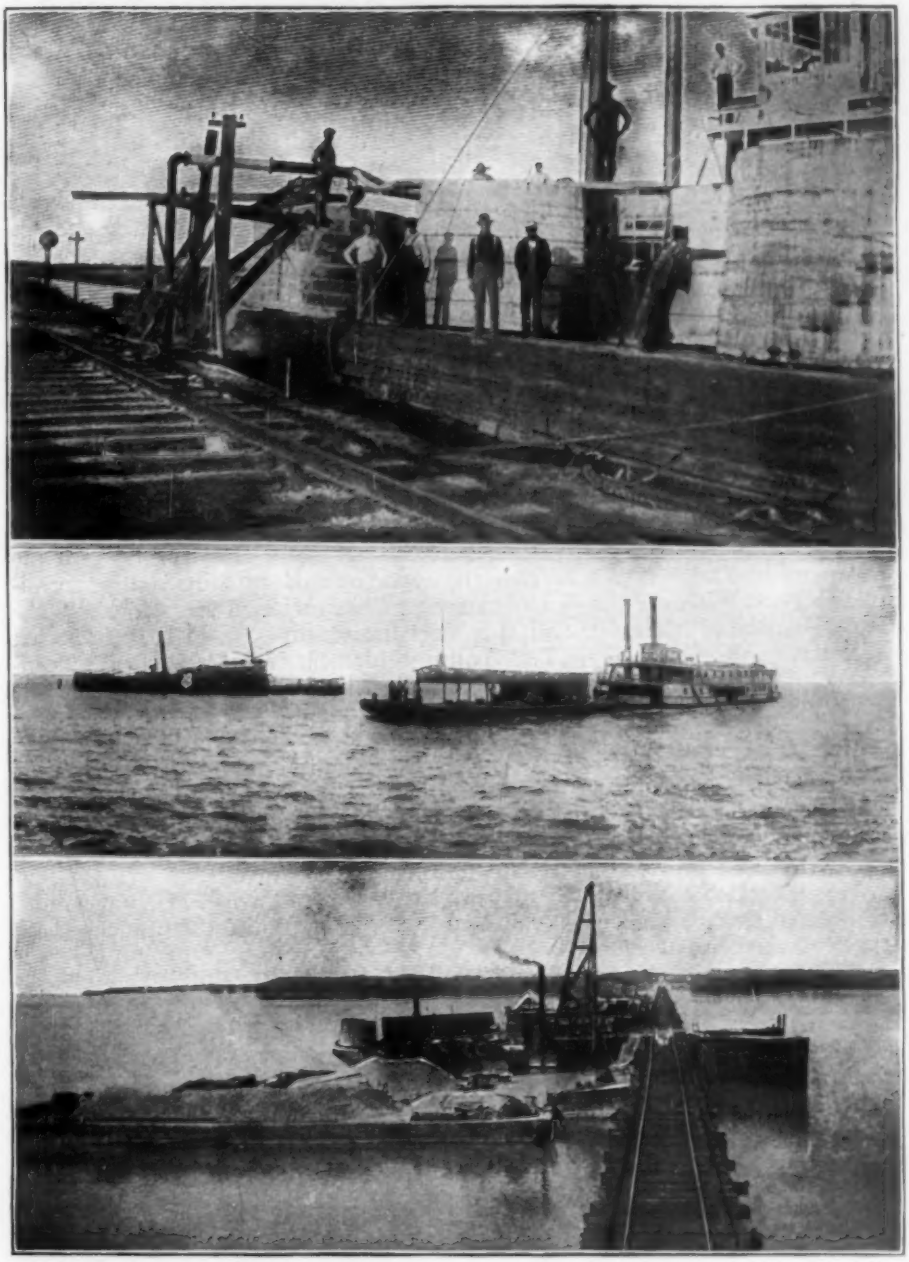
of its projected length is practically completed, and before many days trains will be running to the temporary terminal on Knight's Key; if they are not already doing so. From a comfortable seat in a palace car the traveler will be able to look out on one side across the rolling billows of the Atlantic ocean and on the other side over the waters of the Gulf of Florida, the two commingling directly beneath the tracks which bear the train. After crossing many diminutive coral keys the passenger will be finally set down on Knight's Key. There he may step aboard a fast steamer and six hours later land in Havana, having traveled all but 115 miles of the distance from the starting point by train.

The effect as far as the traveler is concerned will be the same as if the genii of the sea should connive with "Father Time" to pick up Cuba, the Pearl of the Antilles, and move it an hundred miles or more nearer to the United States. The journey to Cuba from New York, or any other point in the east, will be shortened nearly one-third in point of time. Leaving New York on any wintry evening, the traveler will be able, on the second afternoon, to step ashore in Havana, having made the entire trip in less than 48 hours.

The effect of the completion of the enterprise on the development of Key West will be wonderful. It will place it on a par with Galveston, Mobile and New Orleans as a port of entry. Within four hours of Cuba, it will become the port of entry to that island, and will also be the nearest railroad connection for the Panama Canal, Hayti and San Domingo.

The undertaking is doubtless the most remarkable piece of railway building now under construction. The distance from Miami, the Florida terminal, to Key West is 156 miles. Of this distance 104 miles will be constructed on land; counting, of course, the coral formation of the keys as land. The rest of the route, which will connect the string of keys, will be constructed over swamp and water, of which about 25 miles may be considered swamp and 25 miles open water.

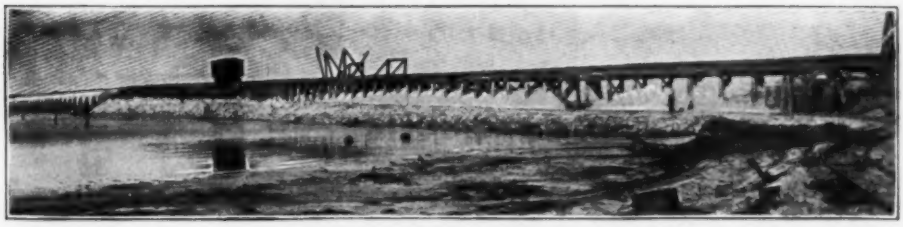
On the entire route 50 keys must be crossed. Some of these are of considerable size, that is, they have an area of several square miles, but the larger number can be measured in square yards. The distances apart vary considerably, and the depth of water between varies from a depth of 30 in. to 30 ft., the average being about 6½ ft. Included in the 156 miles will be 6 miles of concrete viaduct and some 80 miles of embankment, which rises about 31 ft. above the water, this height being considered ample to protect the track from the action of the storms.



Loading Supply Barge with Fresh Water--Barge and Steamer Carrying Ice, Food and Water--Concreting Gang and Outfit at Work

The grading on all the keys has been practically finished, and the greater number of the concrete arches, bridges and embankments completed. Only 10 bridges had to be constructed.

The longest viaduct is between Long Key and Conch Key, a distance of



Approach to Long Key Viaduct

10,500 ft. The three other viaducts are across Knight's Key channel, a distance of 7,300 ft.; across Missouri Key channel, a distance of 7,800 ft., and another 4,950 ft. across Bahia Honda Key. The Long Key viaduct consists of 185 arches, each having a span of 50 ft. resting on piers set in the solid coral rock.

The difficult problems faced and overcome by the engineers were enormous. Since this was to be a railway at sea, sea craft had to be utilized chiefly in its construction, and a navy of heterogeneous craft was assembled. The keys are mostly uninhabited and afford neither shelter nor support for the army of men employed. It was necessary to establish camps, transport supplies, and build hospitals for the sick. Reading and club rooms were also established where the workers could find relaxation from the monotony of isolation. Big dormitories or floating living quarters were anchored in sheltered spots to house the men. All food supplies, ice, and even drinking water, have to be transported on barges from the mainland. The floating equipment includes 3 tugs, 8 stern-wheel steamboats, 3 pile-drivers, 72 barges and lighters, 40 gasoline launches, 12 dredges, 16 houseboats, 10 work-boats, and a large, thoroughly equipped floating machine shop.

By the time the work is completed it is estimated that 176,900 cu. yd. of crushed rock, 106,100 cu. yd. of sand, 286,000 bbl. of cement, 5,760 tons of reinforcing material, 612,000 lineal feet of piling and 3,580,000 ft. of lumber forms for arches will have been used. The crushed stone is brought from the Hudson river, the gravel from Mobile, and the cement from Germany.

It is estimated that the concrete work has cost more than $500,000 per mile, and the grading over the keys by hand labor $6,000 per mile. The average cost per mile of road is $100,000.

"Roof" Umbrella as Worn

GERMAN UMBRELLA LEAVES HANDS FREE

In many parts of Germany, in the fields and along the roads, a new design in sunshades and umbrellas which fasten to the shoulders is being used. Especially adapted for people who must have their hands free while working or seeking pleasure in the hot sun or on rainy days, the device has gained an almost instant popularity.

The frame consists of a number of steel rods, hinged and jointed together, over which a square piece of cloth is stretched. This takes the form of

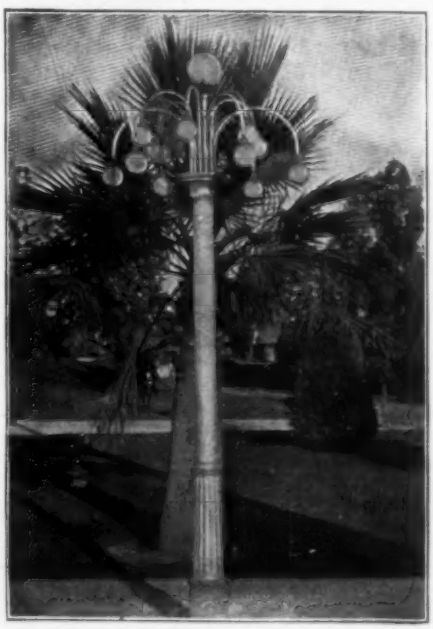
a roof, open in front and rear. The device is fastened underneath the shoulders by means of straps and rubber bands. When not in use it can be folded into a neat, compact package.

GLASS DESK TOPS SAVE TIME

Plate glass as a desk top has many excellent features. Under the glass can be placed all kinds of data constantly referred to, such as telephone numbers, etc. Many business men spend an average of an hour a day looking for data which have been stuffed away somewhere. Under a glass top they can always be found and are never in the way. It also furnishes a smooth writing surface, easy to clean. The cost is comparatively small.

ARTISTIC LAMP POSTS

Artistic lamp posts for parks and avenues can be easily made at any small shop with a few assorted pieces of gas-pipe and two simple cast-iron designs. The middle section of this post is made of 5-in. gas-pipe, and the top and bottom pieces of cast iron. The central lamp is held by a 1-in. pipe and the others by ½-in. pipe.



Made of Gas Pipe

ELECTRIC INCLINED ELEVATOR

At St. Moritz, in the Swiss Engadine, there is a novel electric inclined elevator in operation. The car swings on an axis supported by trolleys running on the elevated rails. The whole arrangement is somewhat similar to an inclined cable railway. The hotel is built on a hill overlooking a lake, and the elevator carries the guests between the lower level and the main floor of the hotel.

Steel towers are used for supporting the curved rails, which are mounted on a light steel lattice-work. The total height is 92 ft. and the total length of travel about 132 ft., as measured on the curved track. Six passengers can be carried at a time, the working load of the car being 1,000 lb., and the speed 150 ft. per minute. A safety catch is provided, and the passengers start and stop the car by pushing a button.

WATER TOWERS IN LONDON

The immense water towers recently added to the equipment of the London, Eng., fire brigade are used with excellent effect. In this illustration are shown two of the towers looming up over the top of one of London's tallest mercantile buildings. London, however, is not a city of skyscrapers, and such towers if in use in New York and Chicago would only reach to the top of eight and nine story buildings.

EXPLOSIVE FORCE OF WATER

Water, looked upon as the tamest of liquids, is as great an explosive as dynamite, under certain conditions. In one day water breaks up more earth and rock than all the gunpowder, guncotton and dynamite in the world do in a year. These explosives can be controlled by human agency, but water does not hold itself accountable to man. It runs into the ground, freezes, expands, and splits the soil into little pieces. Finding a crack in a huge rock, it repeats the same process, forcing it asunder. If frozen in the pores of a tree it often explodes with a report like a gunshot and the force of a dynamite bomb.

SLOT MACHINE SELLS STAMPS

A committee has been appointed by the Postmaster General to test the various stamp-vending machines recently patented, for the purpose of selecting the most perfect for the use of the department. This step on the part of the postal authorities has been contemplated ever since a number of the patents were issued. It now remains with the committee to examine the 20 or more machines offered and make a selection.

The new devices are not only considered as labor and time-savers, but with their substitution in the place of clerks it will be possible to place them in the corridors of large office buildings and on every street corner, where they will be in constant service.

Stamp Vending Machine

According to statistics 1,250,000 men are engaged in digging coal for the world.

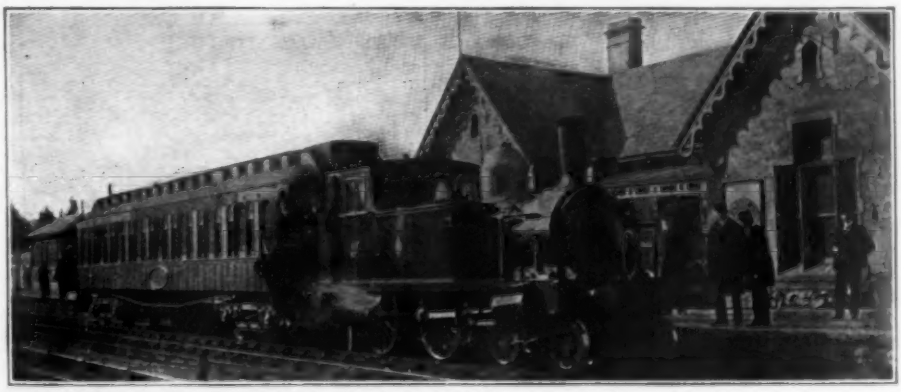
HOW AN ELECTRIC SHOCK FEELS

Assistant Chief James W. Bennett, of Trenton, N. J., had a narrow escape from being shocked to death by an electric wire during a fire, says the Fireman's Herald. An overhead wire fell and struck Bennett on the shoulder, and he received shock after shock until the wire rolled from the body. In speaking of the mishap Assistant Chief Bennett said:

"The shock was terrible. The first thing I realized was a blow on the shoulder which knocked me down. It was heavy, but did not hurt. It seemed weighty, and when I struck the ground I was fully conscious, but could neither speak nor breathe. I felt as if my whole body were being crushed between a powerful vise, and still there was no pain. It was a distress and I was fully conscious of what was going on. The pressure seemed to continue, and I could feel myself losing consciousness all the time, and still there was no pain. I seemed to be sinking. There was then relief suddenly and I was picked up by some one and carried out. This was after the wire had rolled off, and I could hear what was said about me. I knew what was going on, and yet I could not speak. I seemed to gain my equilibrium and in a few minutes I realized what had happened."

ELECTRIC TOWER AT SAN JOSE

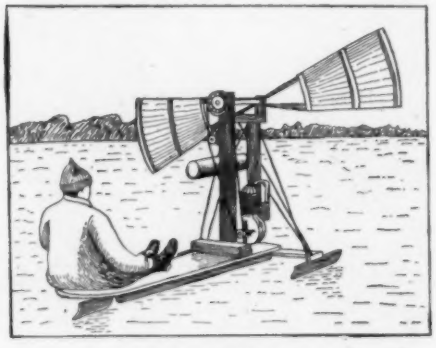
San Jose, Cal., has an electric light tower 220 ft. in height, which lights the business district with twelve 2,000-cp. lights which form a ring at the top. The tower at its base has foundations at the curb line, making four arches. These with the entire framework have been fitted with several thousand incandescent lights.



An American Pullman Car on an English Railway—Has Been Running 20 Years and Is Still in Use

MOTOR ICE BOAT PROPELLED BY AERIAL SCREW

The motor boat shown in this illustration is driven by a 4-hp. motor

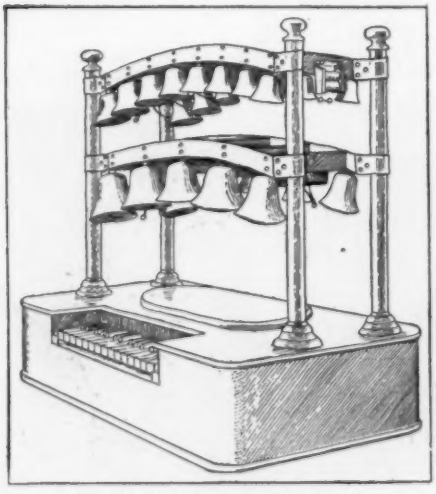


Motor Ice Boat

which propels an aerial screw. The average speed of the boat is 30 miles an hour. At this speed the wings of the screw whirl so rapidly as to be almost invisible.

ELECTRICAL BELL-PIANO

Among the queer recent additions to the class of freak musical instruments is a bell-piano, the invention of a Chicago man. It is an electrically-operated instrument and has a keyboard like a piano; but instead of playing upon wires the hammers strike bells hung in a frame above the main body of the instrument. The hammers are not connected with the keys by direct attachment as in the piano action, but are worked by magnets, which are controlled by the keyboard.



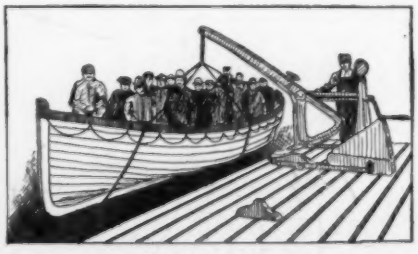
Played with Ordinary Keyboard

CAMPER'S FOLDING WASHSTAND

A recent convenience for hunters and campers is the folding washstand which packs away in a space 2 in. square by 3 ft. long. The frame is hardwood and the bowl of heavy rubber duck. It can be set up or knocked down in a moment, and the spread of the four legs provides a firm stand not easily tipped over.

TESTING QUICK-ACTING DAVIT

With the davit shown in this illustration, one of the principal features of which is the horizontal traveling motion given to the davit arms, two men can swing the heaviest lifeboat clear in 20 seconds. The shortest time in which the same feat can be performed with an ordinary davit is 4½ minutes, which means a loss of over 4 minutes in times of peril when every second counts.



Launched in 20 Seconds

BLIND BOYS PLAY FOOTBALL

Most of These Players are Totally Blind

Of all the remarkable achievements credited to the blind, the work of the football teams of the Kentucky Institution for the Education of the Blind is perhaps most unusual. The illustration is from the publication Outlook for the Blind, and shows one of last year's teams lined up ready for the play. Mr. B. B. Huntoon, in charge of the institution, writes us as follows:

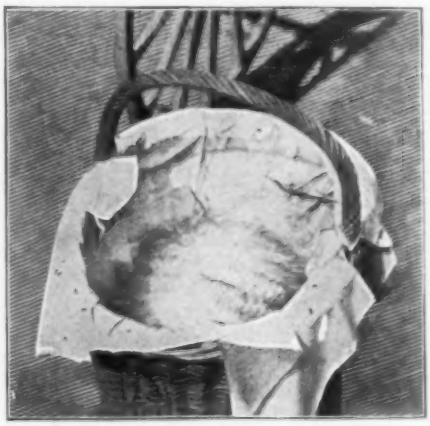
"Our football squad now numbers 26 boys, no one of whom has perfect sight; 15 of these are totally blind. We have never played a game in which any one of our side had perfect sight; never one with less than five and frequently with seven totally blind boys."

TESTING TIMBER

The soundness of a piece of timber can be ascertained by placing the ear close to one end of the log, while another person delivers a succession of blows upon the opposite end. The vibration will indicate to an experienced ear the degree of soundness. If only a dull thud meets the ear, the timber is unsound.

CARRYING WATER IN A BASKET

When it is necessary to carry water and a bucket is not available, take a basket and cover its interior with a yard of cheap table oilcloth. Not a drop of water will be wasted. The basket in the illustration was filled with water when the photograph from which this cut was made was taken.



Basket Full of Water

HYGIENIC MILK-VENDING MACHINE

As an example to milk dealers and slot machine manufacturers is given a description of a hygienic slot machine which furnishes hot or cold milk to the school children of Germany.

One slot furnishes paper cups, which are thrown away after being used. When the coin is placed in the slot the milk tap protrudes from the box, and when a lever is released it disappears again to be rinsed by a device which cleans it thoroughly. When hot milk is desired, an indicator is moved over the "warm" mark, and enough milk to fill one of the cups leaves the tank and runs over a flat surface under which a spirit lamp is burning. The lamp lights when the indicator is moved.

As is usually the case in Germany, the sanitary regulations are fulfilled to the letter. Once a day the milk tank and its connections are taken out and cleansed thoroughly.

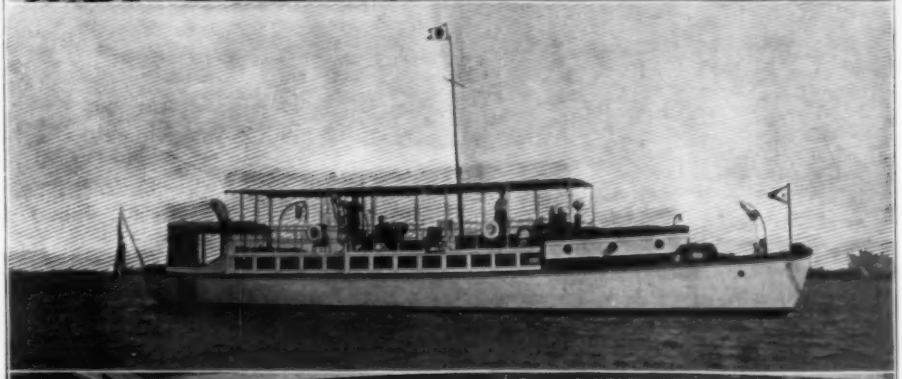
ATTRACTIVE MOTOR YACHT

Of the many designs of motor boats and yachts now before the public, the yacht shown in these illustrations is one of the most pleasing in construction, every line harmonizing. Her hull, 70 ft. long, with 12-ft. beam, is designed on the modified whaleboat style, sharp at both ends. The cabin-top forms the main promenade deck, and is roomy enough for several easy chairs. Aft there is a small cockpit fitted with easy lounging benches. This leads into the main saloon, which is roomy and comfortable, with cushioned side seats, which make up into berths. Forward of this saloon is located the owner's stateroom.

The engine-room, galley and quarters for the crew of one or two men, are all forward. The boat is driven 10 miles an hour by a 30-hp. engine. A complete electric light plant furnishes current to light the boat and for a searchlight.

"MAURETANIA'S" ELECTRICAL EQUIPMENT

The electrical equipment of the "Mauretania" is the largest afloat and ranks with many equipments on land for supplying cities of 100,000 inhabitants. For distribution throughout the ship there are nearly 100 tons of cables, having a length of 250 miles. The main switchboard is in two sections, one in each engine room, and so arranged that should one compartment become flooded with water the lighting could be supplied from the other side. There are over 6,000 lamps of 16 cp. used for lighting the ship. In the public rooms the fixtures were specially designed to harmonize with the decorations. In the staterooms handsome ceiling lamps are fitted, as well as portable reading lamps, electric radiators, curling-tong heaters and fans. For the ventilation of the ship there are 90 electric motors.



INTERPOLE LIFTING MAGNETS

When the electrically charged lifting magnet commenced a few years ago its task of revolutionizing the process of lifting heavy steel and iron objects, almost as many designs of magnets were found necessary as there were different shapes and forms of metal to be lifted. Now, after rapidly undergoing a few revolutions itself, only two really distinct shapes are necessary—the bell and flat magnets. In the numerous changes made in the internal mechanism the "interpole" was introduced.

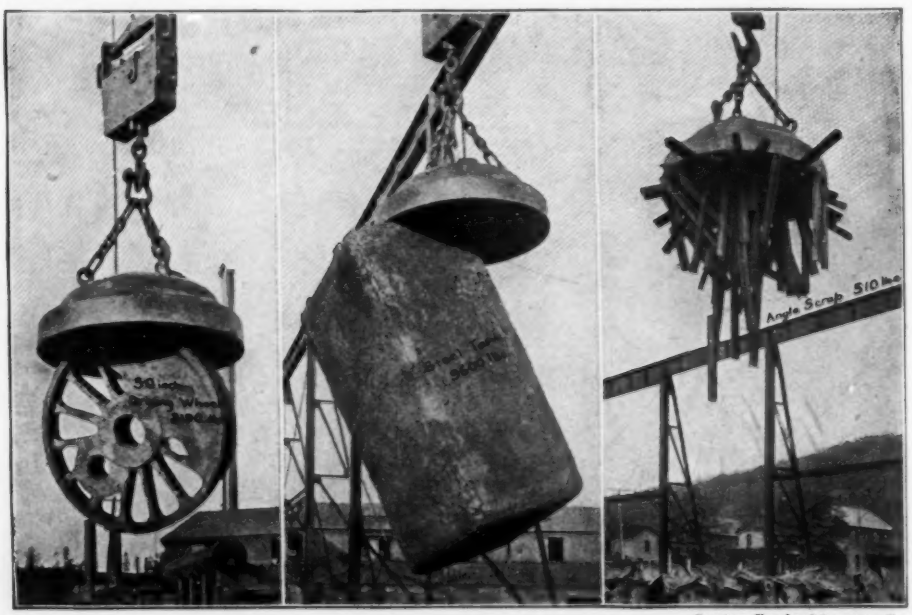
The bell-shaped magnet, with a lifting capacity of from 1 to 12 tons, is designed especially for handling pig iron, scrap iron, skull crackers, one-piece ingots, and all kinds of large or small irregular shaped steel or iron objects. The flat magnet handles any kind of flat surface pieces weighing from 1 to 12 tons.

Both types of magnets are made in two sizes, 32 and 52 in. in diameter. The 52-in. bell magnets weigh 4,500 lb. and require a current of 20 amperes of 220 volts. The flat large-sized magnet weighs 2,500 lb. and requires a charge of 27 amperes of 220 volts. The smaller magnets weigh about 1,000 lb. and require only half the power. The current is supplied to the magnet through a twin conductor cable, which is wound upon a reel mounted on the crane carriage.

Electromagnets are also used for lifting and handling large panes of glass. As glass is a non-magnetic material, a piece of sheet iron is placed under it and one or more magnets applied on the upper face. The magnets attract the sheet iron and therefore hold the glass suspended while moving.

The Japanese government is building an unusually large torpedo boat which will carry one heavy gun and four torpedo tubes. Her displacement will be 1,100 tons and her speed 39 miles an hour.

The Hamburg-American line is to try a ship gyrator which is claimed to reduce rolling at sea by means of rapidly revolving balance wheels. The test will be made on the "Silvana."

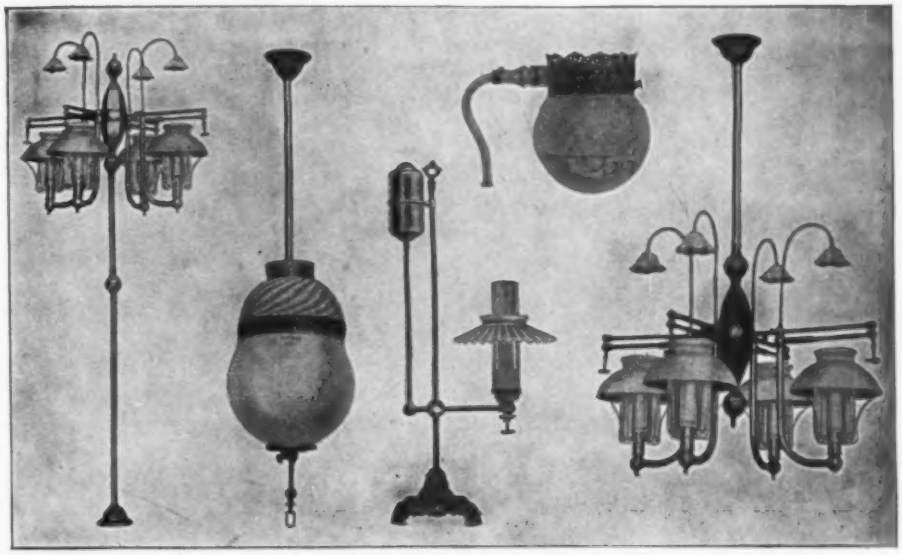


Courtesy Cleveland Armature Co.

Great Weights Are Lifted by this Invisible Force

DIRECT LIGHTING BY GASOLINE

Great Strides Made Toward Its Perfection in Past Two Years—State Legislatures and Insurance Underwriters No Longer Oppose



Types of Single and Cluster Gasoline Lamps

Direct lighting by gasoline is as far advanced today over the smoking gasoline flare light of 15 years ago as the electric lamp now in use is ahead of the first incandescent electric lamp invented by Thomas Edison.

Today incandescent gasoline gas lamps, fed by the direct system, are used in thousands of homes and business places, not only in the smaller communities and rural districts where facilities do not exist for a gas or electric light plant, but in metropolitan cities where the competition of immense electric lighting and gas companies has to be faced and overcome.

The system is now considered safe, efficient and economical. A few years ago when direct lighting by gasoline was first introduced, in rather a crude state, a number of states legislated against it as dangerous. Today all such adverse legislation has been done away with, because this light is considered as safe as any other. Insurance companies have also removed the ban in the past two years, on condition that the rules and requirements for the construction, installation and use of gasoline systems, drawn up by the national board of insurance underwriters, be conformed with. All the companies manufacturing this lighting system now keep inside the letter of these rules, one clause of which permits 6 gal. of gasoline in the tank, instead of the 1 gal. formerly allowed. In its earlier stages the light was not understood and many people were afraid to use it because it was "gasoline." Statistics now prove that with the same amount of precaution used in burning other lights, it is as safe to use as gas, kerosene lamps or electric lights.

The system is simple. Any number of fixtures or chandeliers, almost identically the same as the common gas fixture, with the addition of a generator, can be lighted or turned out at will. Each burner has its separate generator and shut-off valve, which makes it possible to turn the light up and down.

This generator, usually placed just above the light, where it is heated by the light itself, changes the gasoline as it passes through it into gas fit for burning on the mantles. On the large inverted arc lights, which have from 2,000 to 3,000 candlepower, the generator is placed in a vertical position just below the mantles, and is heated by the heat concentrated within the globe.

The generator is a brass or copper tube, from a quarter to half an inch in diameter, and from 6 to 8 in. long. This is packed with copper cable, or asbestos, as the case may be, with a brass gauze attachment at the end. As the gasoline enters this tube it vaporizes and in the form of gas spreads over the mantles and makes a clear, strong light. It is impossible for the raw gasoline to reach the mantle when burning.

The gasoline tank or reservoir is placed in any part of the building desired, and driven by compressed air, the gasoline passes through a copper alloy tube about $\frac{1}{8}$-in. in diameter, or larger, to each light. A few strokes of an air pump attached to the tank will make a sufficient air pressure to run the system for a period of from one to two days. If a portable lamp is desired a small tank is connected with the fixture above the light and the gasoline carried to the generator by gravity.

One manufacturer is now putting on the market a boulevard arc lamp which is exceptional for many reasons. Hardly to be distinguished from an electric arc, it gives out a penetrating shadowless light which can hold its own with any street lighting system in existence. The heavy iron standard has two arms, from each of which hangs a lamp containing six inverted mantles. The two lamps combined throw out a 4,000-candlepower light. At the base of each standard is a tank holding 6 gal. of gasoline.

The latest designed lamps for interior lighting are inverted the same as an electric lamp. No shadows are cast by this style lamp and the globes and shades completely hide from view the mantles.

TIMBER WARTS VALUABLE

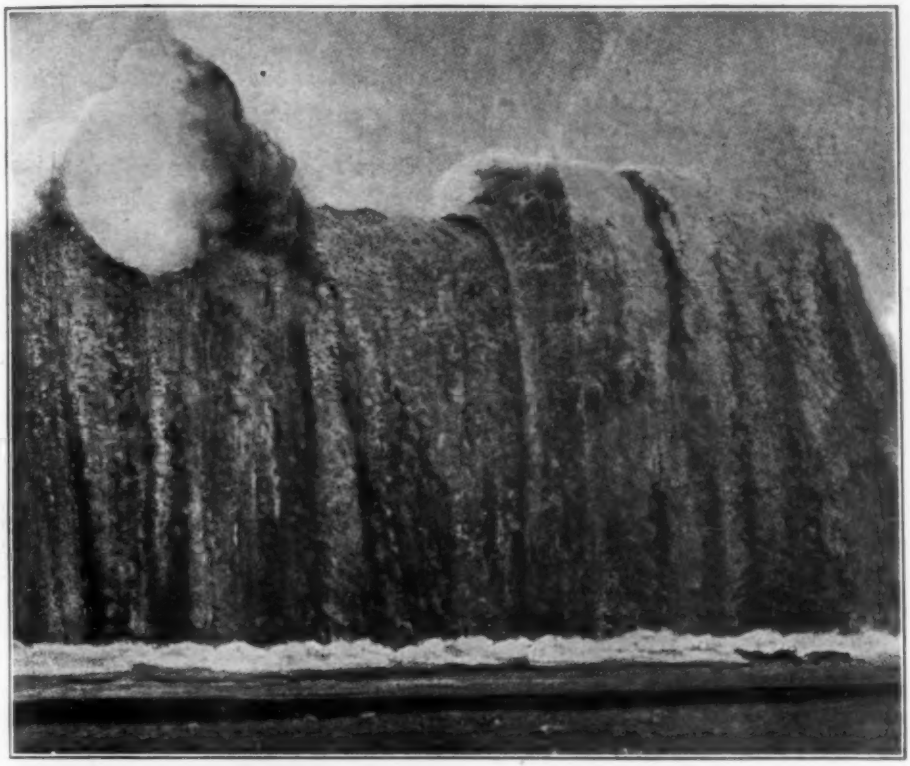
A real walnut burl, or timber wart, as it is known among lumbermen, although not the most costly wood in existence, ranks high in commercial value, both on account of its rarity and its beauty of figure. Burls are caused by the distortion of the grain, which is curled or twisted out of its natural position. They are freaks of nature.

Courtesy Hardwood Record
Burl, or Timber Wart

The cause of this distortion has never been fully determined, but it is probable that it is started by the sting of an insect, or a bruise, by which the flow of the sap is partially diverted from its proper channels, when the tree is young. These freaks of nature have brought as high as 10 cents a pound. At this figure the burl shown in this illustration is worth $200.

Reports from Paris state that the "Matin," one of the Parisian newspapers, has decided to organize an automobile race from New York to Paris, via Chicago, Alaska, and across Behring Strait, through Siberia and Russia.

FIGHTING THE TIDAL WAVE



A Mountain of Moving Water of Incalculable Power

Along the coasts of South America and in the Orient millions of dollars are being spent each year for the erection and maintenance of breakwaters as a protection to shipping from tidal wave and typhoon. The tidal wave shown in this illustration broke upon the breakwater at Rio de Janeiro, and the water shot upwards to a tremendous height, appearing more like a solid wall of rock than water. The remarkable picture conveys a fairly good idea of the enormous power of water when rolling in upon a harbor filled with shipping. The curvature of the wave is very suggestive of the attitude of a great snake advancing with raised head.

The folding envelope was first used in 1839.

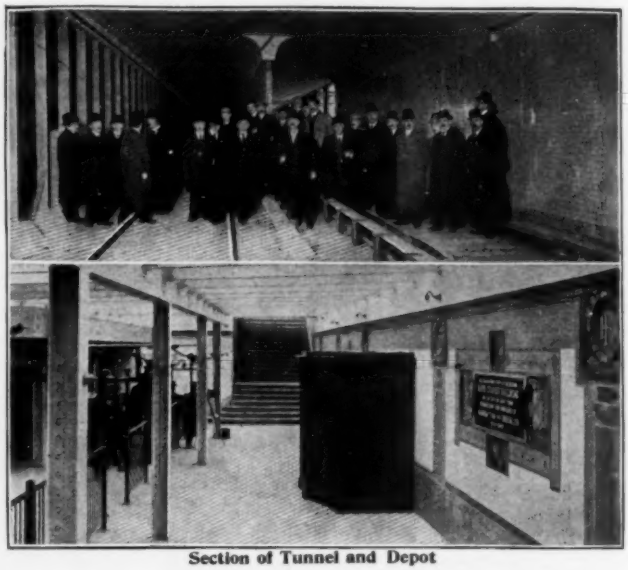
BINDING CUT STONE TO CONCRETE CONSTRUCTION

In binding cut stone against a concrete building, ½-in. pieces of steel are inserted in the wet concrete at just the height of each block of stone. Just before the stones are set, upright ½-in. rounds are placed in position and around them at each joint are hooked two pieces of wire shaped like a mutilated "W."

EAST RIVER TUNNEL COMPLETED

After numerous delays, in which many stupendous obstacles were faced and overcome, the battery tunnel under the East river, connecting Manhattan and Brooklyn, has been completed and trains are now in operation. The distance from Bowling Green station to Borough Hall is 1.6 miles and the tube itself is 1.2 miles long. The first journey was made in 5 minutes.

The tunnel consists of two tubes running parallel. Each tube is 15 ft. 8 in. in diameter. The upper half is semicircular, but the lower half is broken by the bench wall, which is built out so that the sides of the cars are quite close to it. This wall contains the conduits through which the cables run, and is wide enough for a foot-path.

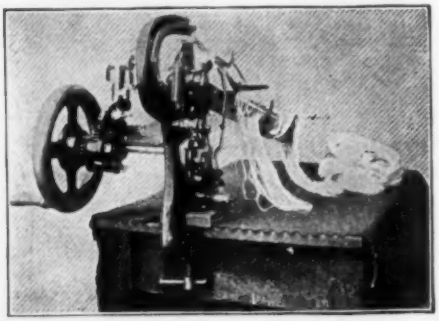


Section of Tunnel and Depot

FISH NET MACHINE

A Norwegian inventor after a number of years of study has turned out a hand net-making machine by which any fisherman can easily make and repair his own nets. The weight of the machine is about 45 lb. The spool carrying the thread is of ordinary construction and can easily be filled by hand. The knot made by the machine is the same as formed in hand net making and is absolutely firm. The mechanism shown near the end of the long steel rod keeps the rows of meshes parallel during the construction of the net.

The machine is easily operated by means of a handle on the flywheel, and will tie from 60 to 80 knots a minute. A net of any length, and 400 meshes wide, can easily be produced.



Net Making Machine

NEW GUN CLEANER

The new gun cleaner illustrated carries wire gauze on one side and rubbing wool on the other. It can be adjusted to any gauge.

To clean a dirty, powder-caked gun barrel, plug one end and pour vinegar into the other.

STEEL-CONCRETE PAVEMENTS FOR PARIS

Steel pavements, so called, but in reality concrete reinforced with a steel form so closely constructed that the shoes of any horse and a wheel of any width must rest in part on the steel and in part on the concrete, are being constructed in front of the Conservatoire of Arts and Industries in Paris.

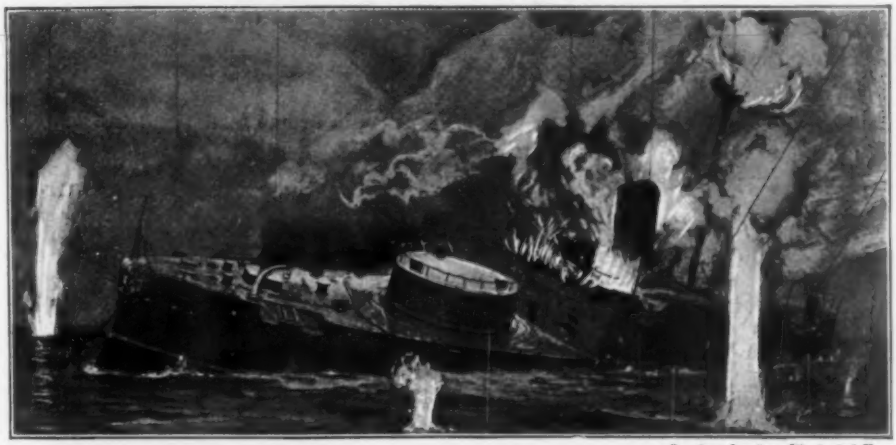
The metal part of the pavement is a plate of perforated steel with strong bolts running through it between the perforations. Each section is somewhat in form of a steel barrow, only the prongs project equally on each side and are square and blunt.

The plates are arranged close together on a bed of rough concrete such as is used for wood block pavements. Specially prepared cement is shoveled upon them in a soft condition and rammed down until it makes a solid mass, with the steel frame just leveled off with the upper tips of the prongs. The prongs are so close together that the smallest horseshoe will rest in part upon them at every step.

By this method a highly durable but uneven surface on which horses can secure sure footing under all conditions is possible. Dangerous ruts will be eliminated. The cost of this pavement is about $5 a square yard and its life is estimated at 10 years as a minimum period.

A BATTLESHIP AS A TARGET

The "Hero," one of England's obsolete war machines, built 19 years ago, was silently towed away to the Long-

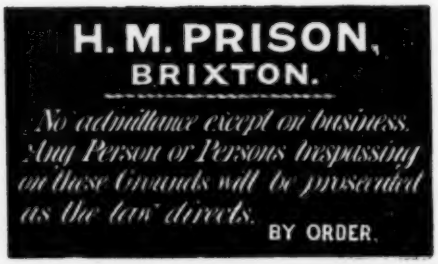


Courtesy London Illustrated News

Battleship "Hero" Sinking While Under Target Fire

sands range to serve as a target for the 12-in. guns of two of England's proudest battleships of today. Probably before another 19 years has passed these two ships will meet the same humiliating fate from the guns of still more powerful sister ships, unless their fighting careers are ended by an enemy before that time.

Before being fired upon, white lines were painted on the "Hero's" sides, dividing up the surface into squares distinguished by letters. A set of fire control instruments were fitted in her, and dummy figures posted where the officers in charge of instruments would have been stationed in real action. After the sacrifice, which bears witness to the awful destructive power of an up-to-date battleship, nothing remained of the brave old "Hero" but a mass of riddled iron and steel.



On the grounds and buildings of the prison at Brixton, England, a number of unnecessary warnings have been placed, of which the illustration is a facsimile. It is hardly to be supposed that any person would want to spend any time there except on serious business, or under compulsion for crimes committed.

SKI-JUMPING IN NORWAY

Ski-jumping, the winter sport of Norway, annually claims the greatest enthusiasm and attention. At the annual ski-jumping contest which takes place at Holmenkollen, a hill situated about three miles from Christiania, from 30,000 to 40,000 people gather, as the football rooters and baseball fans gather in this country when a championship is being played for.

"Great Skill is Required"

Usually about 100 of the most expert ski-jumpers in the country compete. To make the leap the jumpers rush down a steep incline about 400 ft. long, to a little raised platform or shoot-off ledge. The incline gives the jumpers a tremendous impetus, and when the ledge is struck they shoot out into the air for a distance of from 70 to 110 ft. Great skill is required to retain an upright position when the landing is made.

CANOPY LAWN TABLES

This canopy table, designed for lawns, country clubs, open air cafés and parks, embodies both the comfortable and artistic. The canopy, 9 ft.

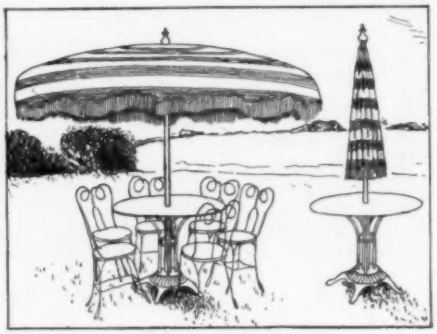


Table and Canopy

in diameter, is fastened to a framework of strong steel ribs. The pole is inserted in a pipe which is screwed into the ground. At the end of each rib is a ring on which curtains, made of the same heavy sail drill, can be fastened for protection from sun and wind. The table is made of enameled metal.

ACETYLENE GAS DRIVES AUTOMOBILE

The constant fear of automobile enthusiasts, that gasoline may run short and leave them stranded ten miles from "nowhere," need no longer be seriously considered if the acetylene tank which feeds the lamps has not also run empty.

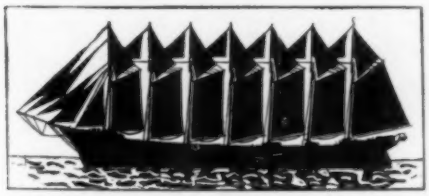
Experiments show that acetylene gas

will drive a car with as great if not greater speed than gasoline. To make the proper connection the acetylene tank should be placed on the seat beside the driver. The connection between the carbureter and gasoline tank is then severed and a union established with the acetylene tank so that the gas enters the carbureter through the same spraying nozzle by which the gasoline found entrance. The control is the only difficult problem, a second person being necessary to handle the valve which regulates the flow.

It is not expected that acetylene gas will to any extent replace gasoline as a motor fuel, being much more expensive, but in case of such an accident as above mentioned it may save time and trouble.

GREAT SEVEN-MASTED SCHOONER FOUNDERED

After a fierce three weeks' battle with heavy gales on the Atlantic ocean, the great seven-masted schooner "Thomas W. Lawson," the largest sailing vessel in the world, turned turtle and foundered off the Cornwall coast, England, on Friday, Dec. 13. Of the crew of eighteen only three were rescued. She left Philadelphia on Nov. 19, bound for London with a cargo of



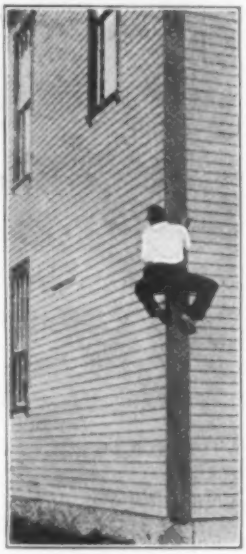
Wrecked on English Coast

oil, and during the entire trip was buffeted by the storms.

The "Thomas Lawson" measured nearly 500 ft. from the tip of the 85-ft. bowsprit to the end of the boom on the seventh mast. Lighted by electricity, steered and heated by steam, and provided with seven stationary engines to raise and lower the immense spread of canvas, the great ship was one of the grandest examples of the type of craft rapidly disappearing from the face of the waters.

CLIMBS CORNER OF A HOUSE

By simply clutching his bare toes around the edgeboard, and gripping with his hands, a strong man named Jack Currier, who has recently appeared from the Maine woods and hills, can climb to a height of 50 or 60 ft. up the corner of a frame building.



A Hard Climb

Currier is 6 ft. tall, over 50 years old, and weighs about 180 lb. During a recent fair at Norway, Maine, he performed the feat of climbing 48 ft. up the corner of the agricultural exhibit building thirteen times in three days.

Physicians who have examined Currier say that his ability as a strong man is due to the wonderful development of certain muscles which are unknown to most men, or, in fact, to all save anatomists.

Perhaps hundreds of years ago, when the white race was in a more or less wild state, these muscles were among the best developed in the body, but they have gradually declined with disuse until at present they are only found dominant in the monkey tribe.

The trackage of electric railways in the United States is 40,000 miles, as compared with 225,000 of single track of steam railways.

SEATLESS MOTORCYCLE

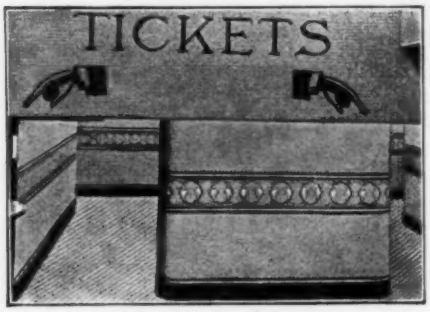
This small English motorcycle is designed without a seat. The operator stands on two foot-plates placed on

No-Seat Motorcycle

each side of the rear wheel only a few inches from the ground. The machine is intended for short-distance riding at moderate speed. The vibration is claimed to be materially less, and mounting and dismounting much easier.

MOSAIC LETTERING

As is shown in this illustration, the word "tickets" is done in dark mosaic, on a mosaic background. Such lettering is not only artistic and pleasing to the eye, but lasting. Unlike paint, which quickly becomes soiled and dingy, mosaic lettering is part of the wall itself and lasts as long as the wall survives, and is restored to original brightness by washing.



Never Fades Out

FLOATING MOTOR-DRIVEN SAW-MILL

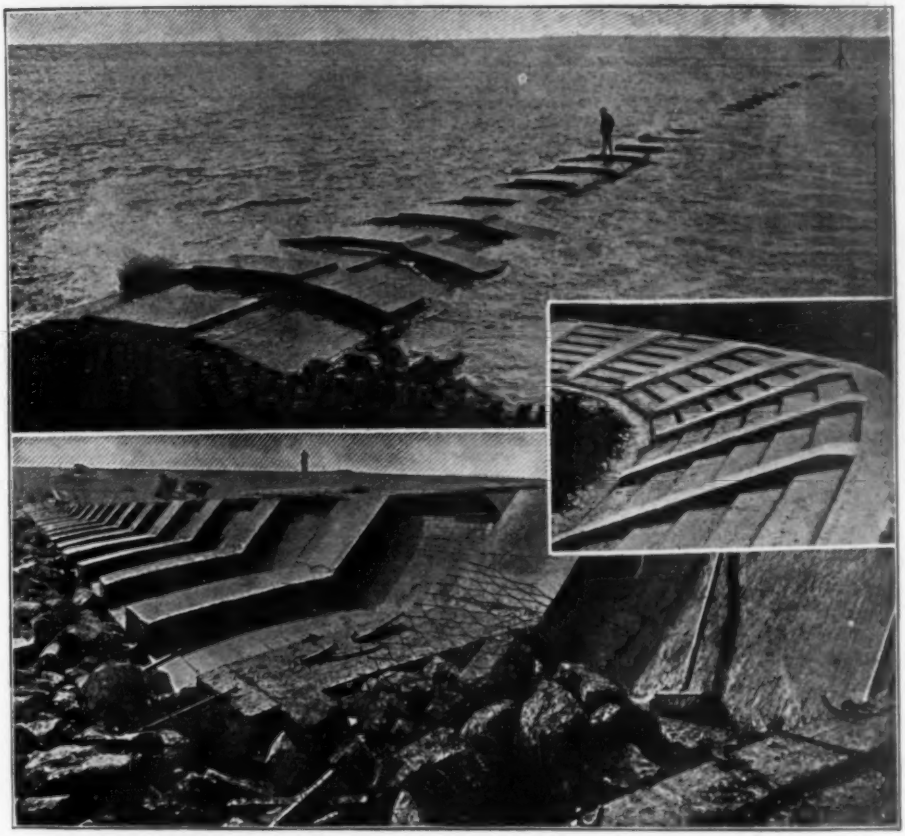
The important feature of this illustration is the small boat, or scow, shown at the edge of a raft of logs. In it is a 6-hp. gasoline engine which drives a cross-cut saw. This saw cuts up 100-ft. logs into 18-ft. lengths, so they can be more easily dragged onto the apron and carried to the big circular saws which cut them into boards.

In nearly all the sawmills in the

Floating Sawmill

United States this operation is performed by a stationary cross-cut saw built over a log run. This boat, however, bumps up against the logs as they lie loose in the booms and cuts them into proper lengths for the final slaughter. The logs are held securely against the saw by grapples. It is claimed that only two of these floating saws are in use in this country. This scene is on the California coast; the 100-ft. or longer logs are rafted down from Washington.

REINFORCED CONCRETE FOR SEA DEFENSES

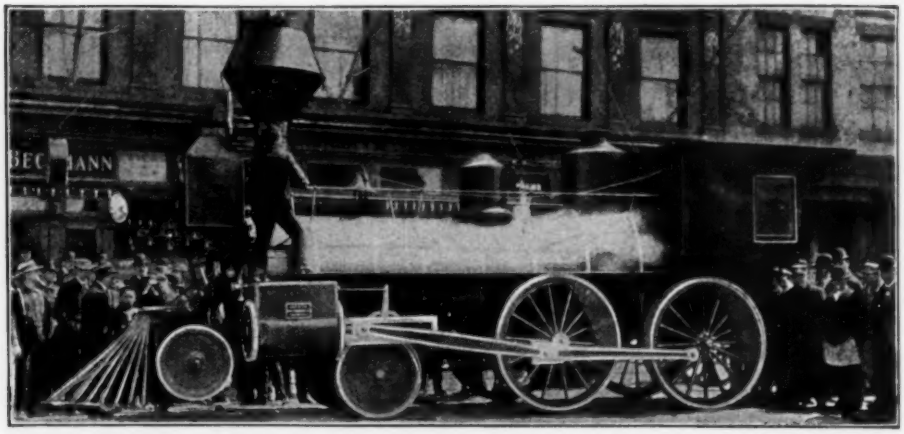


Views of the Concrete Groin for Sea Defense

Upon the Holderness coast of Yorkshire, England, the North sea is devouring 1,904,194 tons of cliff every year, and the shore line at some points scarcely remains the same for two consecutive days. Along the English coasts and the coasts of Holland millions of dollars are spent every year in grappling with nature's destructive aggressions. In fact, as much money is annually spent along these coasts to keep the water out as is being annually spent on the Panama canal to get the water in.

In the past few years concrete has become the chief factor in the fight against the inroads of the sea. The system used in Holland has brought out the great possibilities of concrete for sea-defense construction, and the English engineers are rapidly adopting it. By this system the protected area comprises a series of concrete slabs independent of one another, and held in place by reinforced concrete frames. Between each slab iron armor is inserted and then a channel is dug to a depth of 18 in. beneath the edges of the slabs and filled with concrete. This method affords a perfect continuity between the slabs, but each slab is perfectly free to become displaced within its own frame without disturbing the neighboring slabs.

In the construction of a groin, or a breakwater extending out from the

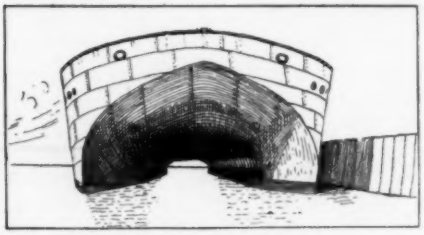


This railway locomotive, which is nothing more nor less than an automobile in disguise, notwithstanding the smoke pouring from its funnel, made triumphal trips through the streets of New York recently as part of the street parade of a big show. The smoke from the funnel is made by over-lubrication.

shore at high-tide, the slabs have a raised back, each of which is a little higher than that immediately preceding it. The expanded metal reinforcement is itself reinforced by six 1-in. iron bars at every knee. It is impossible for the groin to be forced over by the thrust of the water without these iron bars being broken and the entire structure dislocated. It is the application of the continuity of slabs and framework which causes this construction to effectually resist the rush of water.

DOCK TO RAISE SUNKEN SUBMARINES

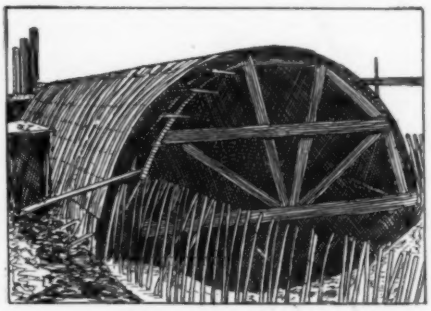
Owing to the large number of submarine accidents in which men have been imprisoned under water for hours and finally suffocated because the rescuers could not raise the craft to the surface, an inverted floating dock has been constructed at Kiel, Germany, which is intended to raise a sunken submarine with the least possible delay. Cranes having a lifting capacity of 500 tons raise the sunken vessel to the surface, where it is made fast within the concave bottom of the dock.



To Recover Submarines

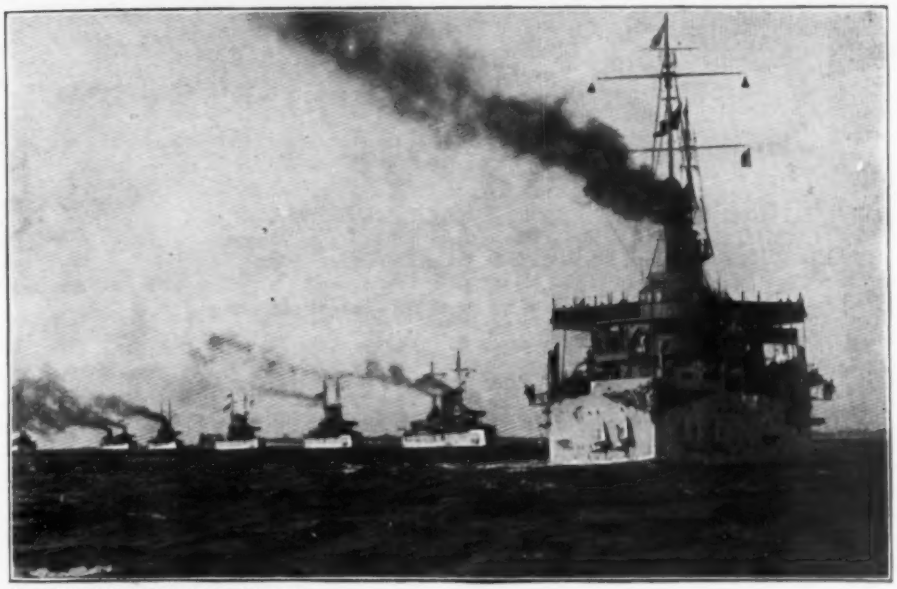
LARGEST CONCRETE SEWER

The Harlem creek public sewer in St. Louis, Mo., is said to be the largest reinforced concrete sewer in the world. It is 4,800 ft. in length and has a clear span of 29 ft. This illustration shows the wooden forms and the reinforcing rods of steel in place ready to receive the layers of concrete.



Arch is 29 Ft. Across

AMERICA'S GREAT WAR FLEET



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The Fleet Putting Out to Sea from Hampton Roads

On December 16 the "Battle Fleet," as it is designated by President Roosevelt, left Hampton Roads on its 13,772-mile peace cruise into the Pacific. The ships, tonnage, number of guns, officers and men are given in this table:

Battleships.	Tons.	Horsepower.	Guns.	Officers and Men.
Connecticut	16,000	16,500	74	1,121
Kansas	16,000	16,500	74	881
Vermont	16,000	16,500	74	881
Louisiana	16,000	16,500	74	881
Minnesota	16,000	16,500	74	881
Georgia	14,948	19,000	74	881
New Jersey	14,948	19,000	74	881
Rhode Island	14,948	19,000	74	881
Virginia	14,948	19,000	74	881
Ohio	12,300	16,000	44	807
Missouri	12,300	16,000	44	807
Maine	12,300	15,840	44	807
Alabama	11,565	11,366	44	807
Illinois	11,565	12,898	44	807
Kearsarge	11,565	11,954	44	807
Kentucky	11,565	12,318	44	807
Totals	225,475	254,866	1,016	13,280

The second list gives an idea of the supply of food and delicacies necessary for such a cruise:

Flour, 1,205,000 lb.; beef (fresh and tinned), 1,000,000 lb.; ham, 400,000 lb.; tinned meats (except beef), 200,000 lb.; salt pork, 200,000 lb.; sausage, 150,000 lb.; fowl, 76,000 lb.; mutton, 90,000 lb.; lard, 85,000 lb.; potatoes, 700,000 lb.; butter, 150,000 lb.; fruits (dried and preserved), 300,000 lb.; coffee, 100,000 lb.; tea, 3,000 lb.; tinned vegetables, 446,000 lb.; chocolate candy, 17,500 lb.; eggs, 24,000 doz.; assorted cakes, 52,400 doz. packages; cigarettes, 27,500 packages; cigars, 37,000; smoking tobacco, 14,000 packages.

It is estimated that the fleet will consume 130,000 tons of coal on the voyage, which is really the chief item of extra expense, and even this is not as

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Another View of the Fleet—The Connecticut Leading

much more as many suppose. Inasmuch as all the men must be fed and clothed and paid the same whether on a cruise or aboard a ship laying idle in port, the expense of the cruise will really be of no great consequence. But if it should be, it will be worth every dollar it may cost. The prestige which the successful completion of a feat never before undertaken in the history of the world gives is of incalculable value. As one French admiral remarks: "If the fleet can make the cruise and arrive at destination in condition to do target practice, which is the equivalent of being in shape to engage in battle, the navies of the world will take off their hats to the Americans," and he added, "It looks as though such will be the result."

It is to be regretted that so few stops are scheduled at South American ports, for the moral effect upon some of the smaller revolutionary countries would be most salutary.

The spectacle of the great white fleet steaming out into open sea was one of the most impressive sights ever witnessed in this country. A quarter of a million tons of floating steel plowing through the water, bearing 1,016 guns and 13,280 officers and men, is surely something of which to be proud.

The fleet is due to reach San Francisco on April 20; the first stop, Port of Spain, was made 24 hours ahead of schedule.

A rule for calculating the calorific value of fuels is, according to M. Lenoble, as follows: Subtract from 100 the sum of the percentage of moisture and ash obtained from burnt fuel and multiply the remainder by 157.3; the product will be the calorific value of the fuel in heat units per pound.

Gold and silver anodes should not be allowed to remain in the solution when not in use. When no current of electricity is running through the bath the solution has a tendency to dissolve the anodes to some extent which will enrich the solution. Every night the anodes should be removed, rinsed and laid away.

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The President Gives Final Instructions to Admiral Evans

This Wreck Was Caused in a Few Minutes

FIRE-WRECKED LOCOMOTIVES

The mighty devastating power of fire, whether the material attacked be wood or steel, is thoroughly demonstrated in this illustration. The dismantled, fire-warped locomotives are four of fifteen destroyed in the Boston & Maine Railway's roundhouse at East Cambridge, Mass. The fire raged only a few minutes, but when it was over the damage to locomotives alone amounted to $150,000.

WHEEL CONVEYER FOR EXCAVATION WORK

This ingenious conveyer, consisting of a huge wheel, 80 ft. in diameter, on the rim of which the excavated matter is swung over the dump, is a new idea which is proving successful from every point of view. The rim of the wheel is connected to the hub by steel cables, which can be whirled on the hub at any angle. Brackets carry a series of plates 3 ft. in width which extend around the rim. On this surface the excavated material is automatically dumped by a revolving hopper, and is carried around until it meets a stationary blade of steel which shoots it off onto the dump.

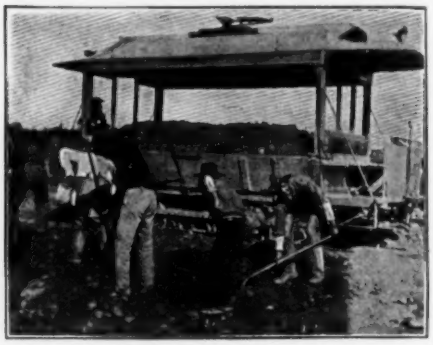
The method of propulsion is simple. A rope passes around the rim, making the wheel in principle a mammoth pulley. By moving the "shoot-off" blade to any desired position on the rim the excavated matter can be leveled to such an extent in dumping that hand labor afterwards is reduced to a minimum.

Courtesy Industrial Magazine

Unusual Form of Dirt Conveyer

NEW TASK FOR OLD TROLLEY CAR

Too old and decrepit for use as a carrier of human freight, this car was slightly altered and returned again to active life as a self-dumping dirt car.



Self-Dumping Dirt Car

The passenger seats were removed and a new floor, raised 1 ft. in the center, substituted for the old one. The addition of hinged sideboards completed the transformation.

PORTABLE AIR COMPRESSOR

A California gas company finds this portable air compressor almost indispensable for the work of testing gas mains, driving compressed air drills and caulking pipe joints. The compressor is operated by a gasoline engine. Three tanks underneath the flooring of the wagon contain the air.

For Testing Gas Mains

COAST DEFENSE GUNS IN BOSTON HARBOR

The illustrations on the opposite page show both the big and little guns which form part of the coast defenses in Boston harbor. The first of the big gun illustrations is of a 10-in. gun just fired, and the second is the same gun receiving a load. The third illustration shows a detachment of riflemen and a machine gun preparing to repel a landing party from behind a trench.

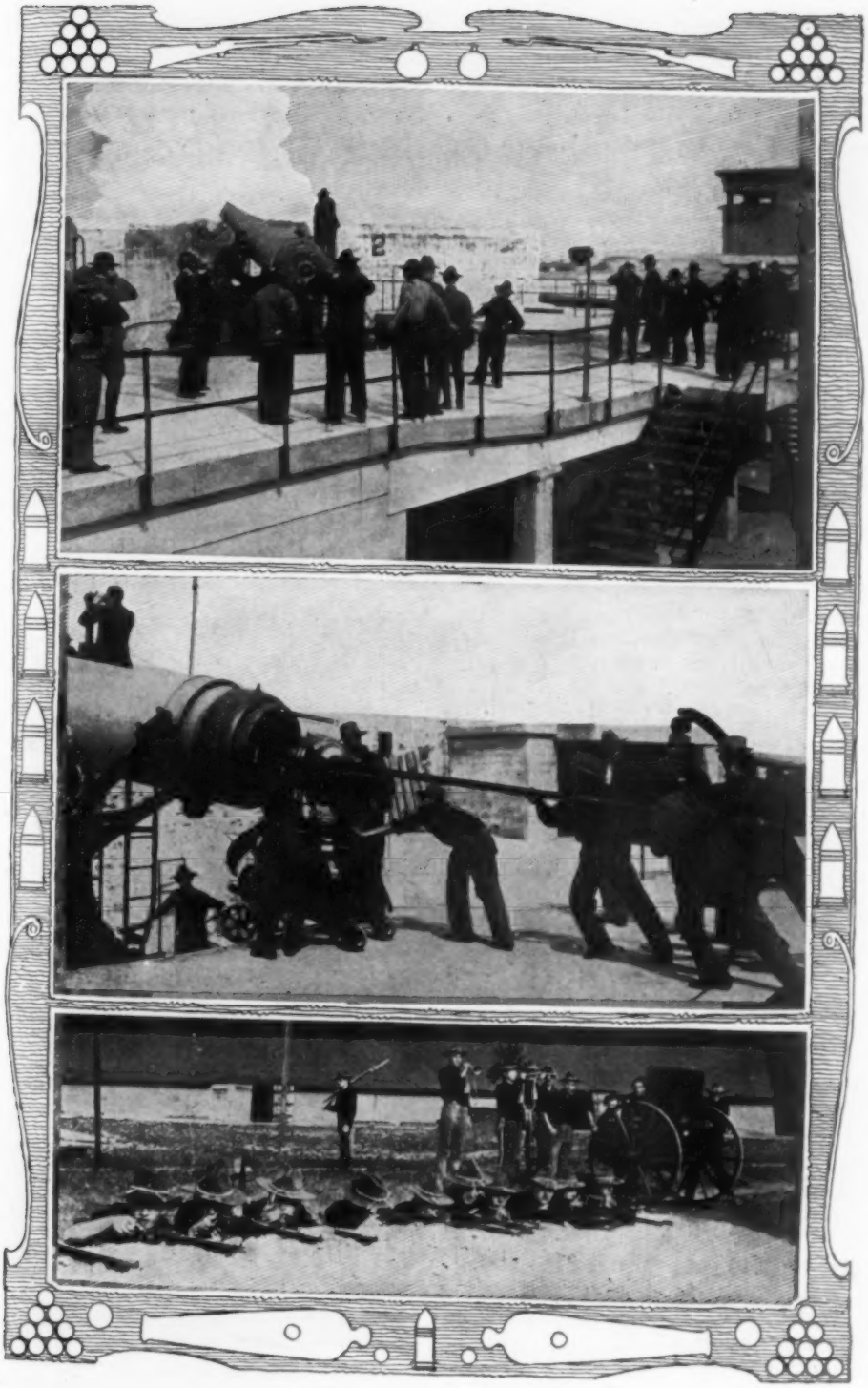
ELECTRIC LOCOMOTIVES FOR SOUTHERN PACIFIC

It has practically been decided to increase the capacity of that section of the Southern Pacific railroad (136 miles long), which crosses the Sierra Nevada mountains, by installing electricity as a motive power.

The difficult character of the problem is due to the length of the line, the grades, and the heavy, but irregular traffic. East bound traffic must be lifted nearly 7,000 ft., within a distance of 83 miles. Over this section of the road, which is single track, all the freight and passenger traffic of the Union Pacific road to and from central California passes. Many sidings, high curvature, and 31 miles of tunnel and snow sheds lend to the difficulties.

Freight trains, of 1,000 tons and even more, must be run over the line at greatly increased speed to keep congestion broken. The average grade in the 83 miles is over 1½% and at times 2½%. The locomotives now in use burn oil, as it is difficult to haul heavy trains over this division by means of coal during the winter months when certain sections are covered with snow 20 ft. deep.

A company in Japan is manufacturing a product from volcanic ashes which is being substituted for cement. The demand is so rapidly increasing that more plants are necessary to supply the orders.



SUPERIORITY OF TILE FOR BATH ROOMS

The comparative merits of marble and tile for bath rooms have been tested, and marble found wanting. In the first place, marble is more or less porous and therefore absorbs germs and dirt. It is easily scratched by any sharp object, stained and injured by acids of all kinds, and cannot be joined at the union of baseboard and floor so as to eliminate cracks and corners.

Clay tile, on the other hand, is virtually non-porous. The glazed wall tile is covered with a non-porous glaze which prevents absorption, and although the unglazed floor tile absorbs a small percentage of water, no septic matter can pass beneath its surface. It is impossible to scratch it, as the sharpest instrument will only leave a mark like a lead pencil, easily erased. Tiles intended for baseboards, corners and edges can be formed into any required shape before being baked, so that the properly tiled bath room need have no corners or cracks to catch germs.

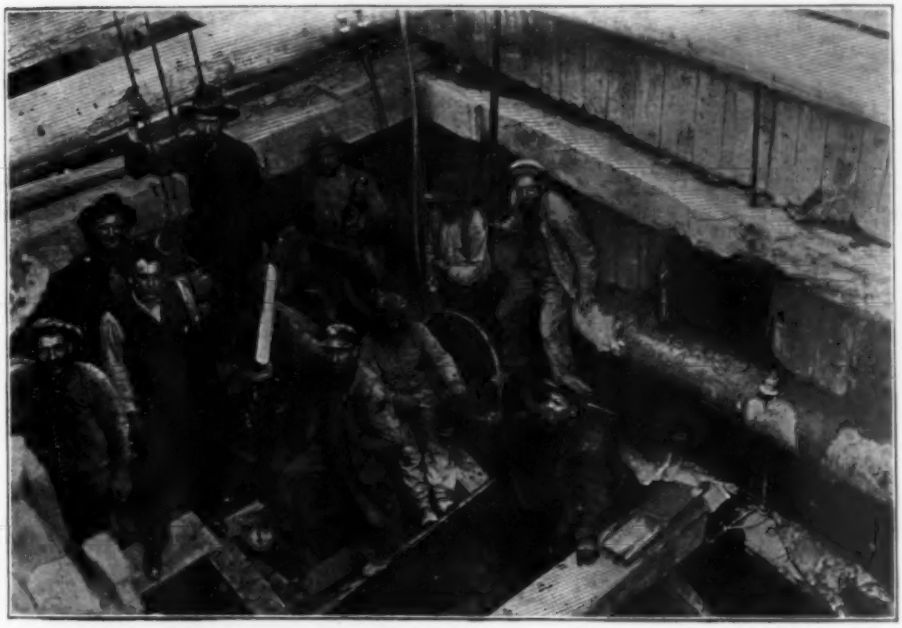
DREDGING GREAT TRENCH ACROSS DETROIT RIVER

Constructing the railroad tunnel under—or, to be exact, through—the river at Detroit involves engineering problems of great magnitude, some of which are being worked out in an entirely original manner by the engineers in charge.

Instead of tunneling under the river a trench is being dug by a massive clamshell dredge, at present operating in 42 ft. of water. The trench will be 48 ft. wide at the bottom, to accommodate the twin steel tubes that are sunk and bolted together as rapidly as completed, and which will form the tunnel proper. As the government requires the top of the tunnel to be 35 ft. below the surface of the river, it necessitates a long reach to get at the ground which is being removed. The bottom of the trench is 65 ft. below the surface of the river.

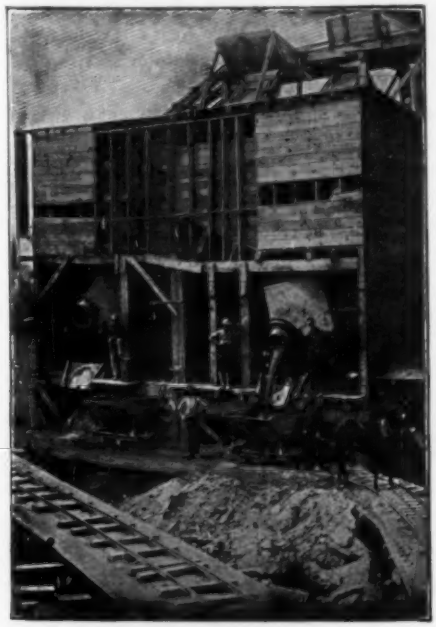
Dredging the Big Trench

Another interesting feature is the work of the twin shields which will be used for excavating on the Canadian side, and which will travel underground 3,200 ft. They are made of heavy steel, with knife-like blades ca-



At the Bottom of One of the Shafts

pable of penetrating the heavy clay encountered, and are 28 ft. high and 20 ft. wide. Each shield will be propelled by 21 hydraulic jacks, each capable of exerting a pressure of 60 tons.



Concrete Mixing Plant

Vast quantities of concrete are required in building the center wall and the roof and sides of the tunnel, and a double concrete mixer capable of turning out 100 carloads daily is kept running steadily to supply the workmen, who labor day and night.

Back on the Canadian side, where a longer approach is required than on the American side, because eastbound traffic is much heavier, a massive steam shovel which removes 100 carloads of dirt a day has been at work for months cutting a path for the tracks leading down to the point where the plunge under the river is taken.

RARE GEMS MADE FROM COMMON CRYSTAL

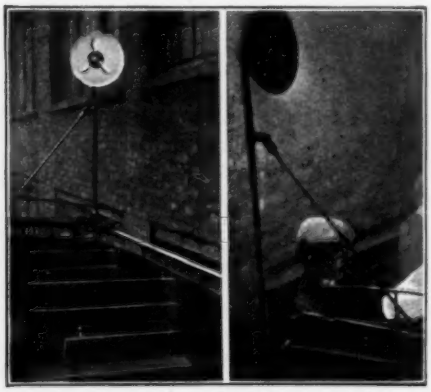
The discovery by which Prof. Bordas changes corundum, a hard crystal worth about 40 cents per carat, into rare gems, has become public through the French Academy of Sciences.

Impressed by the fact that glass

tubes in which radium was kept had taken on a magnificent azure tint, Prof. Bordas took pieces of corundum, which he found in dull brown, blue and violet colors, placed them in contact with a tube of pure radium and left them untouched for a month. At the end of that time the dull brown crystal had become yellow, like to topaz; the blue as green as the emerald, and the violet as blue as the sapphire. The effect of the transformation, according to the jeweler who examined the radium-treated specimens, was to raise their value from 40 cents to $100 per carat.

ILLUMINATED BUS-TOPS

The London "bus," famed in verse and story, is undergoing many evolutions. Gradually the horses have given way before the electric and gasoline



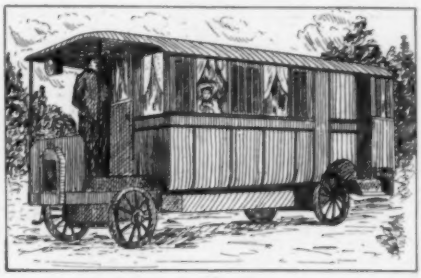
Powerful Reflectors Are Used

motor, and now the Electro-bus Company has decided to dispel darkness from the bus-top as the horses were expelled from the bus-front. An electric light standard is raised above one corner and a powerful reflector spreads the light over the top, making it possible for passengers to read at night while en route.

The oil exports from Philadelphia last year amounted to more than 400,000,000 gal.

TOURING BY MOTOR CARAVAN

M. A. de Fabrigues, a member of the Automobile Club of Marseilles, France, has constructed a motor caravan in



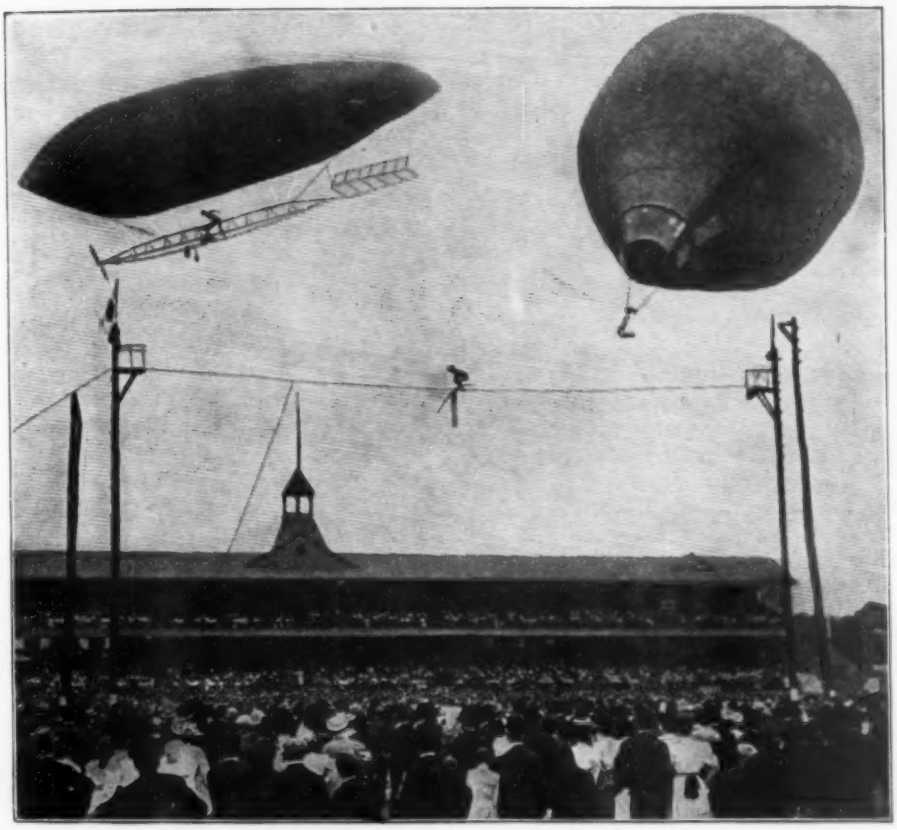
Motor House Car

which he is touring Europe. The caravan has a combined dining and sleeping room in the forward end, in which there are four berths. In the afterpart is a kitchen, which contains two bunks, and between the two a lavatory.

ADJUSTABLE INVALID'S CHAIR

This luxurious adjustable chair is only one of the many comforts invention has devised for making the existence of invalids or delicate persons more easy. There is not a part of this chair which cannot be adjusted to meet the convenience of the person who wishes to occupy it, and the arms are so arranged as to reduce the task of getting into it to a minimum. For an invalid who has to be lifted in and out the chair is specially convenient.

The Arm Swings Out

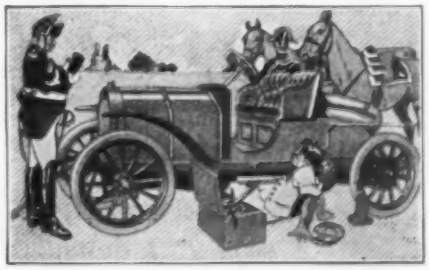


TRIO OF MID-AIR SPORTS

The great popularity of aerial sports is illustrated in the above scene, in which three forms of mid-air performances are occurring at the same time. The old-time tight rope performer divides honors with the latest, the dirigible airship, while an immense hot air balloon is ascending with an acrobat-aeronaut. The photograph is probably the only one ever taken where the three types of aerial entertainment are all going on at the same time.

BLUE PRINT 120 FT. LONG

The printing of what is called continuous blue prints has become almost an art. Recently in Washington the government printers ran off a blue print which contains the details of the extension under way at the United States capitol. This blue print, resembling a canvas blockade as it was stretched across one of the avenues in the grounds, is 54 in. wide and 120 ft. long. It is a single piece containing 540 sq. ft. of paper.



French Gendarme—"Having asked him what he was doing there hidden under the car, he replied that he was hunting a cotter-pin; consequently we have drawn up a summons for illegally hunting an unknown game during closed season."—Omnia.

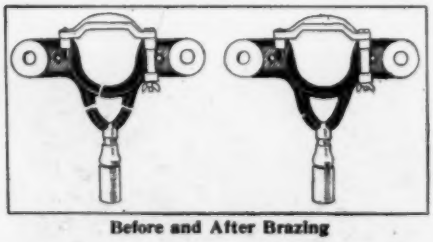
PHOTOGRAPHING CHIMNEY FROM TOP

This illustration, which seems to have no clearly defined top, bottom or sides, was taken from the top of a concrete smoke-stack 175 ft. high. To get the stack itself into the picture the camera had to be held far out over the edge. The square to the left is not the ascending roof of a powder mill following an explosion, but the roof of the boiler-house, intact. The photograph far more resembles work of destruction than of construction.—Photo by H. L. Schall, Decatur, Ill.

Curious Photograph of Concrete Stack

CAST IRON BRAZING A NEW INDUSTRY

Every few minutes in some part of the world inventive brains are devising some new means by which some task, which for years cost a considerable outlay of money, can be accomplished at from one-half to one-tenth the expenditure. Among the latest money-savers is the invention of a process by which cast iron is brazed. For years steel has been successfully brazed, but the process for cast iron is comparatively new, the first work of the kind only dating back a couple of years, and that with indifferent results.



Before and After Brazing

The importance of this new industry is such that in several large cities there has been established a machine shop that makes a specialty of the brazing process. Now from all parts of the country broken castings of every description can be sent in, quickly made as strong as before and returned almost immediately at anywhere from one-half to one-eighth the cost of a new casting, and much quicker than a casting could be made.

With the exception of the application of a chemical, the process is the same as for brazing steel. Cast iron has no elasticity and is so brittle that the blow of a hammer will break it. The chemical overcomes this, so that when the iron expands under the intense heat and then contracts, the molten brass poured into the break fuses with the cast iron.

Cracked automobile cylinders, broken typewriter frames, heavy vices, and in fact every large or small casting in the machinery line, can be successfully repaired at prices ranging from 50 cents to $10. A broken automobile cylinder can be made as good as new for about $5. A new cylinder would cost $30.

The excavation from the Panama canal during the month of November aggregated 1,838,468 cubic yards. This amount of dirt would cover 10 city blocks to a depth of 40 ft.

The postal authorities of Canada estimate that over 50 tons of English plum pudding was sent by parcel post from England to people in Canada during Christmas week.

In order to secure secrecy the Czar's special train is run without any advance notice to the railroad officials. Very often the ordinary traffic is entirely suspended while the train is passing along the line.

IS "DREADNAUGHT" UNMANAGEABLE?

Reports from England state that the great English battleship "Dreadnaught," which has been hailed far and wide as the pride of the British navy, is practically unmanageable and therefore a dismal failure, except, perhaps, as an anchored fortress. Notwithstanding all the denials from the admiralty, the steering apparatus of this huge war machine has been changed time and again, but without success. Three successive sets of propellers have been fitted and the rudders modified with the object of overcoming the qualities which make it impossible for the ship to maneuver with the ease of ordinary vessels.

The fact that England's closest ally, Japan, which was to have constructed two battleships of the same size and power, has decided to construct two smaller and less powerful ships instead, is also significant.

CLEVERLY CONSTRUCTED STONE ARCHES

The stone arches at the main entrance of one of California's cemeteries are considered exceptional in beauty and construction. The long main arch, with a span of 37 ft., is constructed of small cobblestones and cement. Although only 2 ft. thick by about 30 in. in height, nothing was used for reinforcement.

Concrete-Cobblestone Arch, 37 Ft. Long—No Reinforcement

ELEVATED CONCRETE SEWER

In the construction of this reinforced concrete sewerage outlet it was found necessary to elevate and build out some distance on account of the high tides.

Elevated Sewer and Walk

The railing on both sides makes it appear to be a foot-bridge, and in fact it does act in that capacity, providing a fine walk to its outer end.

INVALID'S SEAT IN AN AUTOMOBILE

This "landau" type of automobile, usually the kind driven by physicians, was especially designed for a famous London physician who wished some kind of an arrangement by which he could carry invalids without subjecting them to unnecessary exertion. Half of the seat and back can be detached from the car, with the invalid seated in it, and carried to or from any desired place.

English Physician's Idea

WIRELESS TELEPHONY SUCCESSFUL

Perfect telephone communication without wires has been obtained for a distance of over 50 miles in Germany, across the whole city of Berlin, which lies between the two stations. This was accomplished by using the undamped or continuous waves generated by the aid of an "arc" instead of a spark, as employed in other systems. A feature of the German process is a photographic recording ribbon on which the signals received are printed even when the current is not strong enough to make sound audible in the receiver.

IMMENSE CLOCK ON EIFFEL TOWER

The Eiffel tower in Paris is now being used for another practical purpose. Not long ago a wireless telegraph station was installed, and now on the sides of the second section, hundreds of feet above the ground, a luminous clock warns the gay Parisian of the passing span of life. The apparatus flashes forth every minute in huge figures visible a great distance. This system was found the only practical one, as the ordinary clock dial would be indistinguishable at such a height.

Seen for Miles

The first complete railroad guide for India and Burma, containing the same class of information as the American and English guides, is now being printed in the "Urdu" language.

MOTIVE POWER FROM THE SUN'S HEAT

A Pennsylvania inventor believes he has solved the problem of converting the heat of the sun into motive power, in both a practical and economical way, through the medium of a hot-box constructed on the same principle as the hotbed used by florists and truck-growers.

A box, 60 ft. long and 18 ft. wide, constructed of wood, is placed in the ground. In it are laid coils of iron pipe painted black. The box is covered by two layers of ordinary hothouse glass, with a 1-in. air space between. The rays of the sun penetrate through the glass covering and their heat is absorbed by liquid ether in the pipes and generates the pressure which drives the engine. The inventor asserts that in tropical countries water can take the place of the ether used in this instance. The exhaust passes into a condenser after accomplishing its task and is then returned in its fluid state back to the hot-box. This illustration shows the direct-acting solar engine, under a pressure of 120 lb., pumping water from an artesian well.

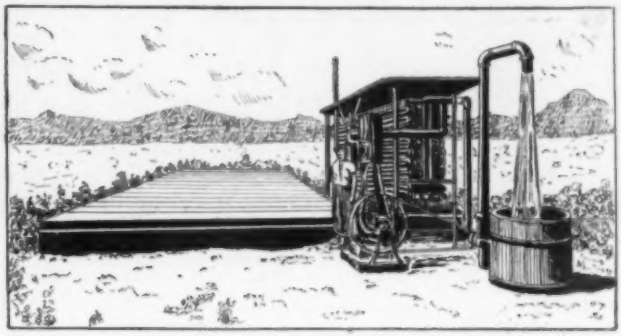
The great drawback is the fact that the sun shines only about 8 hours a day and that some days are cloudy. Therefore the inventor proposes to use solar power for liquefying air, which can be shipped and used for power.

Plans are being made to construct solar plants in the tropics, where humidity is rare and sunlight abundant, to compress indefinite quantities of atmosphere and ship it in bulk.

Liquid air has been used in England to run automobiles. The cost is about $1.20 per gallon in bulk. By the aid of a solar plant the inventor believes he can manufacture liquid air so cheaply that it can be sold for a few cents a gallon.

TWELVE-INCH GUNS SHORT LIVED

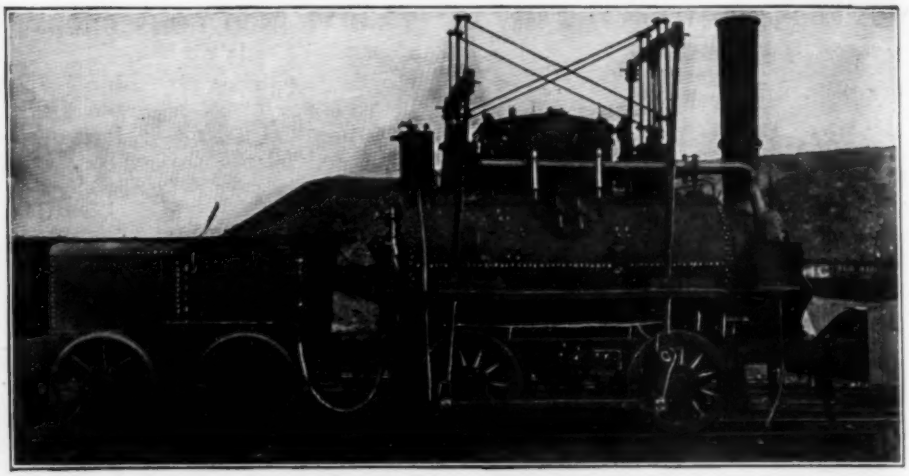
"Under present conditions of firing, the 12-in. guns in United States forts can last but 60 rounds." This is the declaration made by Brigadier-General William Crozier, chief of ordnance.



The Box is 60 Ft. Long and 18 Ft. Wide

This would mean that the life of a 12-in. gun in active service would not exceed an hour and a half, as it is capable of firing at the rate of 45 rounds an hour. Many of these guns are mounted to protect big seacoast cities and it is estimated "that in attempting to run by fortifications guarding the entrance of a harbor the period that would elapse from the time the leading vessels of the fleet would come within range until the last vessel would pass beyond the range of the coast guns would be about two hours. It is therefore evident that a new 12-in. gun would not last through such an engagement."

General Crozier says that by lowering the velocity of the 12-in. projectile to 2,250 ft. a second the life of the gun is increased to 200 rounds, but at a distance of 10,000 yd. the projectile which under ordinary conditions of velocity would penetrate about 10½ in. of armor plate would penetrate only 9 in. To meet this condition the ordnance department of the army has designed a 14-in. gun which will fire a projectile weighing 1,660 lb. and give a muzzle velocity of 2,100 ft. a second. The charge of powder required to produce



This old locomotive recently celebrated its 62d birthday as an active member of the working force of an English colliery. The locomotive was built in 1845. It does not take much imagination to compare it with a grand old man of the same age who all his life has placed his shoulder against the wheel and is reluctant to give up the task.

this velocity is about 280 lb., as against 366 lb. for the 12-in. gun.

With lower velocity and smaller powder charge the 14-in. gun may be shorter than the 12-in. gun, its weight less; muzzle energy 15 per cent greater; life, before impairment of accuracy, 240 rounds, or 6½ hours of continuous firing. Because of its lighter weight the cost of the gun will be less than that of the 12-in. gun, and it will cost $70 less to fire it. The cost of the 14-in. armor piercing shot, however, will be about $100 more than that of the 12-in. shot, so that the total cost of a single round will be about $30 greater. Taking into consideration the rapid deterioration of the 12-in. gun and adding the cost of relining to that of the ammunition, it appears that the cost for each round, including this deterioration, for the 14-in. gun is only about 68 per cent of that for the 12-in. gun.

LAKE ERIE TO PITTSBURG BY SHIP CANAL

Charters for the proposed ship canal from Lake Erie to Pittsburg have been received by the Lake Erie & Ohio Ship Canal Company from Ohio, Pennsylvania, and the National government.

The work of construction is expected to commence in the next year and it is estimated that the canal can be completed by 1913-14. The cost of construction is estimated at $53,000,000.

According to the plans the Lake Erie terminus will be at the mouth of Indian Creek, just west of Ashtabula. The natural waterways along the route are to be utilized, the first division, a distance of 20 miles, being formed by the Beaver river. The Mahoning river, for a length of 30 miles, will constitute the second division. The total rise for these divisions will be 177 ft., requiring 12 locks. The actual canal is to begin at Niles and pursue a route due north to Lake Erie. The approach along the Mosquito valley will require three locks. In the plans provision is made for the construction of a lake 9 miles long at the southern end of the summit. This lake will act as an auxiliary reservoir and provide excellent harbor. The summit is 31 miles long and terminates 13 miles south of Lake Erie. On this descent to the mouth of Indian Creek, Lake Erie, 18 locks must be constructed with a total drop of 327 ft.

FRENCH TOWN LIVES BY CUTTING CORK

Nearly all the cork used in France and a large portion of the world's supply is made in Mazin, a village of 2,700 inhabitants, situated in Gascony. Of this population 1,600 men, women and children are engaged in the thirty-five mills or in the forests.

Gascony has the best soil in the world for cork trees. All through the forests of Gers and Landes thousands of trees of medium height, with gnarled boughs and foliage concentrated into a gray-green ball, thrive. Their robust trunks are covered with a thick, rough, grayish-brown bark, to which many mosses and lichens cling. When this bark is removed the tree trunk looks like the flayed carcass of an animal. The wood is ruddy and drops of reddish gum oozing from it suggest drops of blood.

GERMAN ELECTRIC TRUMPET

In Germany electric trumpets or sirens are utilized extensively on the railways and in the mines for signaling trainmen and operators. The sound produced is exceptionally loud and penetrating.

R. R. Electric Siren

The principle on which the apparatus is constructed depends on the alternating action of the armature of an electric magnet, of a given number of vibrations, on a metallic diaphragm by aid of an elastic double-armed lever. The diaphragm is made of a bronze alloy by a special process, and is arranged to hermetically close the interior of the apparatus. The sound is peculiar and far-reaching.

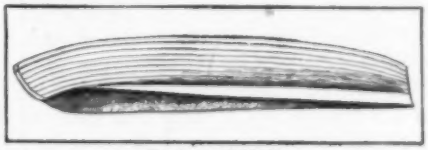
Two of the new Japanese battleships are to be fitted with American turbine engines.

HYDROCURVE BOAT BEATS WORLD SPEED RECORD

For the past few months the interest of the motor-boat marine men of the country has been centered on the wonderful speed trials of one of the latest types of small boats, the "Hydrocurve," designed by a yacht enthusiast at Pearl, Ill. When this boat was first tested on the Illinois river it made a speed of 35 miles an hour. In a later test it covered one and one-eighth miles down stream in 1 minute, 30 seconds, or approximately 45 miles an hour.

Under Full Speed

The hull of the "Hydrocurve," instead of plowing through the water and displacing it to each side of the boat, displaces it from the surface downward, moving each particle of water in one direction only. The bottom is concave, both lengthwise and crosswise, and is wider and of least draft at the bow, narrowing gradually to an apex at the stern, where it is of greatest draft. The sides of the hull are slightly convexed, lengthwise and vertically. By this design every particle of water is set in motion gradually, whereas with the prevailing type of boat, the water is handled fastest at the point of its first contact with the hull. The boat which made this wonderful speed is 40 ft. long, and is driven by an 80-hp. engine.



Design of Hull

THE SEAMAN GUNNERS' SCHOOL OF THE NAVY

The Navy has, in recent years, made some wonderful records at target practice, and a description of how men of the gunners' force are trained may be of interest.

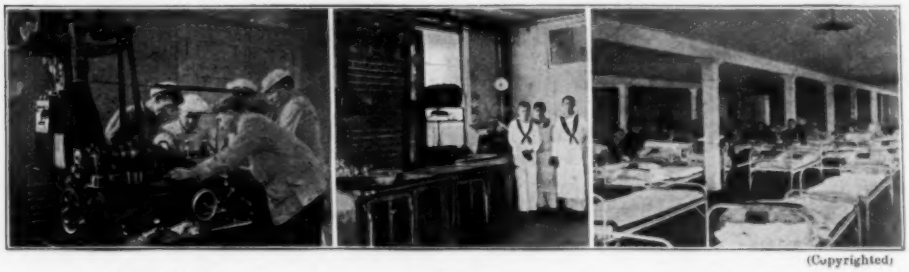
The Navy maintains at the Washington Navy Yard, a school for the instruction of its future gunners. The course is both theoretical and practical. The former comprises regular classes in various text books on ordnance, gunnery, the textile strength of metals, smokeless powder, etc. The practical part of the course consists of assembling the various parts of a gun and breech mechanism. The students are assigned to certain tasks, which teach them the make and use of tools, and put into practice what they have learned from the text books and lectures. They have their own shops, with all modern tools and appliances, and in addition are given assignments in the naval gun factory and forge.

The classes assemble twice a year. The course at Washington extends over a period of five months; the men then undergo their final examinations, and if they qualify they are sent to the naval torpedo station at Newport, R. I. There they learn the mechanical devices for handling and firing torpedoes, diving, laying and exploding mines; and electricity, as applied to ordnance mechanism.

Any young man who has served one enlistment creditably, and returns to the service within four months, can apply for detail to the gunnery class. His pay continues while at the school, and if he has previously been advanced to petty officer, he does not relinquish his appointment by the detail to the class. Examinations are held frequently, and if the student does not take advantage of the benefits offered him, or if he commits any serious offense against discipline, he is promptly returned to the general service.

He graduates from the course with an increase in pay, becomes eligible for an appointment as petty officer, either as gunner's mate, gun captain, or turret captain, and is assigned to duty in the turret or magazine of a battleship, or on board a torpedo boat or submarine. He is on the direct road to advancement to chief petty officer, a position paying $70 a month and allowances. And if he shows special aptitude for his profession, he can, in two or three years after completing the course, compete in the examination for gunner. This is a warrant position, paying from $1,200 to $2,100 a year, with all the benefits of retirement, quarters, etc., which commissioned officers receive. Examinations for this position are held every year.

The accompanying pictures show how the men eat and sleep, and what some of their tasks are.



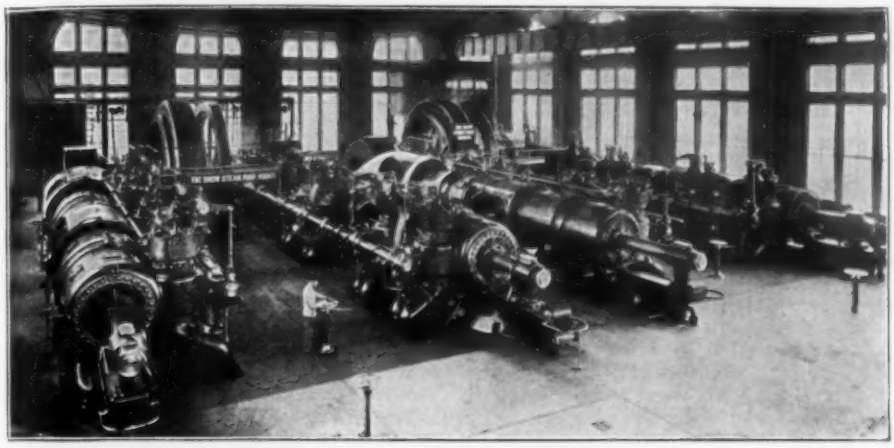
(Copyrighted)

Lathe Work **Kitchen** **Dormatory**

Beira, a little town in Africa, is built almost entirely of galvanized sheet metal.

MONSTER GAS ENGINE PLANT

Gas engines of extreme large size are a matter of recent engineering progress. A group of three gas engines, rated at 5,400 hp. each, is operating at San Mateo, Cal., and running under



Over 16,000 Hp. Generated by Gas Engines

conditions that until lately were considered impracticable for this kind of power.

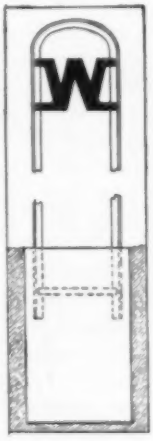
The engines are of the type known as twin-tandem, double-acting, four-cylinder, side-crank machines, and they operate on the four-cylinder principle. Each engine is direct connected to an electric generator. The accompanying illustration of the interior of the plant shows two of the twin units as operated. The total weight of each twin engine is 600 tons, of which 186 tons represent the weight of the two main frame castings. The flywheel is 23 ft. in diameter and weighs 97,000 lb., rather less than might be expected.

The speed of the engines, 88 r.p.m., is regulated by the governor working on the compression and also on the mixture of gas. Electric ignition is used, with a make-and-break spark. The cylinders are water-jacketed. Lubrication of the cylinder is accomplished by a special oiling system which uses oil of a quality that will not carbonize at the high temperatures. The engines are started by compressed air. From a standing condition, they develop a speed carrying the full load in from 55 seconds to 2 minutes.

The gas used by the engines is generated by a crude oil water gas process. The crude oil is vaporized, heated to a temperature of 300°F. and mixed with a superheated steam. After the surplus water is removed it is heated again to 600°, by which treatment the mixture becomes a fixed oil and water gas of a very high heat value.

STEEL WHISTLING POSTS

The old wooden whistling posts, which, unlike nearly every other part of the equipment of an up-to-date railroad, have for years refused to be relegated to the rear by newer inventions, are to be at last superseded by attractive and comparatively cheap steel posts.



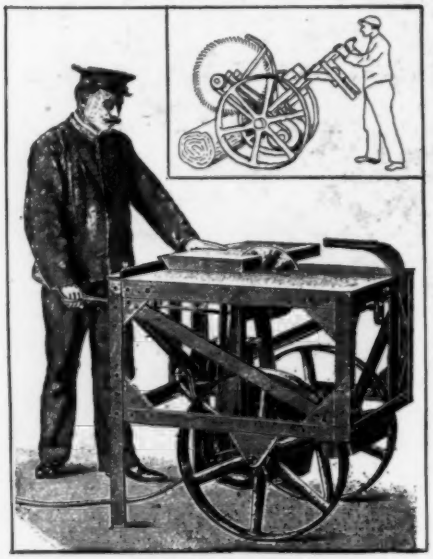
The post is made by bending a piece of structural steel into an inverted U-shape, 7 ft. long, and mounting it in a concrete base. The base is 8 by 16 by 30 in., the steel being imbedded 12 in. The

letters "W" (whistle) and "R" (ring) for these posts are stamped from ⅛-in. sheet iron and are 8 in. high.

PORTABLE ELECTRIC SAW

Saw Forced Through Timber Instead of Timber Pressed Against Saw

A portable electric saw, resembling the street outfit of a scissors grinder, is a recent English invention. The



Traveling Saw Mill

timber remains stationary while the saw is either pushed or drawn through it. The saw for cutting lumber is held in an upright frame. The board is placed on the table, where it remains stationary while the operator pulls the saw through it. With neither outfit is it necessary for the operator to place his hands anywhere near the saw.

The machine for cutting logs is wheeled up against the timber, and as the saw cuts, it is gradually lowered by lifting the handles of the frame. Each type of machine is fitted with a 6-hp. electric motor, starting switch and flexible cable for electric connection. This method of sawing a log takes less strength than the ordinary method.

AN INVALID'S CARRIAGE

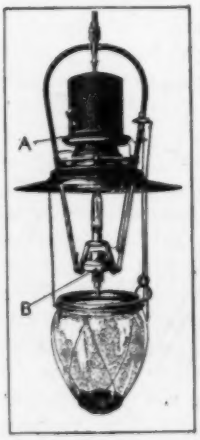
A carriage, in no way to be distinguished outwardly from the well-equipped carriage of a multimillionaire, has been designed to supplant the

Ambulance Carriage

ambulance. The carriage can be used to transfer persons who are too ill to sit up, and do not care to use an ambulance, to and from hospitals, depots, or any other place which it may be necessary. The illustration shows the side of the carriage opened to receive the cot on which the patient lies.

ELECTRICITY HELPS GAS BURN BRIGHTLY

A German inventor has designed a gas lamp which generates its own electricity and uses it as an auxiliary to furnish the supply of oxygen necessary to make a brilliant, powerful light.



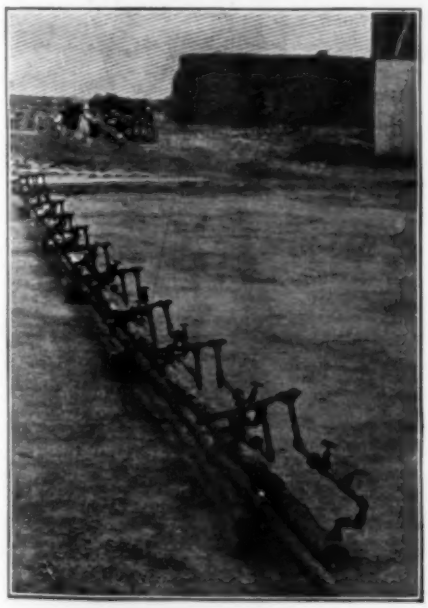
It is well known that in burning gas an unlimited supply of oxygen is necessary, and that if enough is not provided the light will not burn brightly. The feature of this invention is that the necessary oxygen is supplied by the aid of an electrically driven fan, instead of being drawn by

the flame alone, as is the case with the usual gas lamp.

The electric energy is generated by means of a thermo-battery heated by the burnt gases, and a small electromotor is driven by the current to propel the fan which draws in the air. The only movable part of the arrangement is the vertical shaft to which the armature and fan wings are keyed. This shaft is propelled at the rate of 2,000 revolutions a minute. The gas escapes through nozzles beneath the fan wings and thus thoroughly mixes with the air. The mixture then rises to the mantle. An ordinary lamp gives about 1,250 cp. at an expense of 3 cents an hour.

CRUDE OIL BURNERS FOR BRICK KILNS

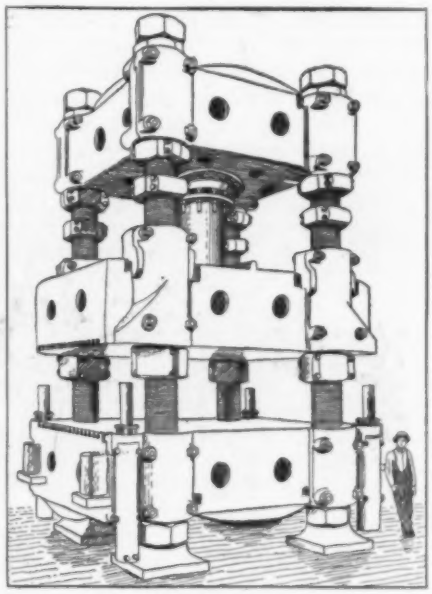
In this illustration is shown a battery of ten crude oil burners used in a brick kiln. The crude oil, stored in a tank 30 ft. above the ground to give pressure, flows through the 2-in. pipe. Steam is driven through the 1½-in. pipe. The small pipes end in a nozzle inside of a ¼-in. steam pipe, and the steam, enveloping the oil nozzle, draws the oil out and throws a hot fire into the kilns.



Burners Removed for Inspection

HYDRAULIC PRESS OF HUGE SIZE

This 1,000-ton hydraulic press is one of three used by a car-building company for making the large pressed



1,000-Ton Press

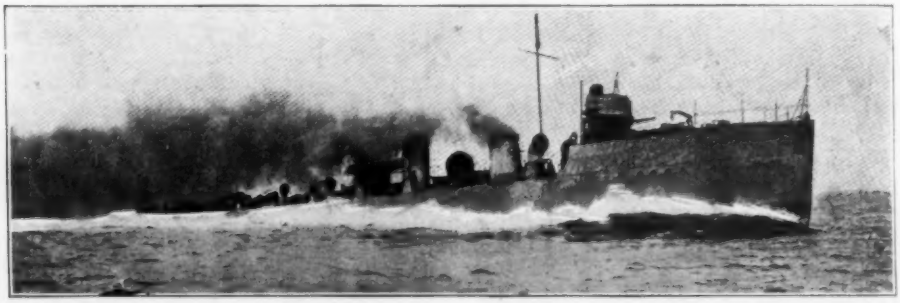
shapes used in steel car construction. The main ram has a stroke of 48 in. and a capacity of 1,000 tons under water pressure of 3,000 lb. to the square inch. The massiveness of the press is shown in the illustration, the distance between the bolts being 9 ft. each way.

A VARIABLE SPEED MECHANISM

In propelling light machinery where it is necessary to have changes of speed from a lower to a higher, or higher to a lower, on a gradual scale, the friction drive was the only thing used. The engraving shows a new variable speed mechanism which not only produces

Variable Speed Machine

the different speeds but is positive in its action. A cone-shaped casting constitutes the main part of the device, which has a series of holes encircling its surface. Each series of holes, starting from the small end of the cone, increases in number as they ascend toward the larger end of the cone. One hole in each series of holes is received in a bar which lies in a groove lengthwise of the cone. This bar is made to slide endwise and is worked by a mechanical device at the larger end of the cone. When it is desired to change the speed the hand lever sets the device, and when the side of the cone turns to the right point the bar with the line of holes moves one series of holes up, or down, as the case may be, carrying with it the small pin wheel on the shaft which runs parallel with the cone. This way, step by step, the small pin wheel is carried from the one extreme to the other.



"Mohawk" Under Full Steam Ahead

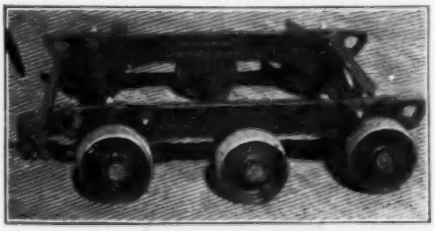
BRITISH WAR RACERS

The "Mohawk," the first of the six ocean-going torpedo-boat destroyers recently contracted for by the British admiralty, ran speed trials in the North Sea with results which indicate that she is one of the fastest if not the fastest war vessel in the world. For the six hours of her trial she maintained a speed of 40 land miles an hour.

The "Mohawk" is propelled by five turbines, three ahead and two astern, driving three shafts and propellers. The steam is supplied by six water-tube boilers, fired by liquid fuel, of which the vessel can carry 73 tons. Her length is 270 ft., her beam 25 ft. and her draught 8 ft. Until the other five are completed and tested out the "Mohawk" will hold the speed blue ribbon of the British navy undisputed.

SIX-WHEELED TRUCK

The wheel arrangement of this truck makes it doubly convenient in a warehouse for moving boxes, bags, etc. The axle carrying the central wheels is ¼ in. lower than the end axles, making it possible for the truck to turn easily

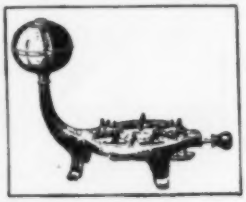


Strong Shop Truck

on the middle wheels without the other four wheels interfering. When pushed ahead it runs on four wheels.

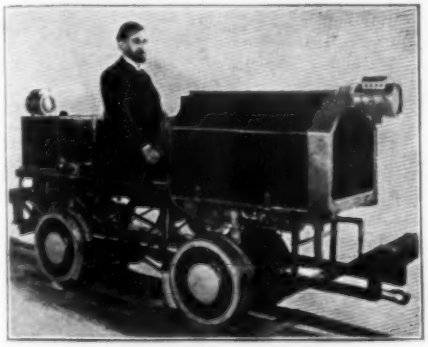
NEW DESIGN ALCOHOL STOVE

This new design in alcohol stoves burns an alcohol gas which it especially manufactures as it is consumed. Unlike the old style stoves, the alcohol reservoir, instead of being underneath the flame, is above and to one side of it. By this arrangement the flames of the stove can be regulated the same as with a gasoline burner. As nothing but the alcohol gas is burned, the consumption of alcohol amounts to no more than two or three cents per hour.



A MINE GASOLINE MOTOR

The one important feature of tunnel mining is the matter of transportation. The cost of transporting ore and waste through the workings of a tunnel is quite an item, and any device which saves time will be welcomed by the operator. Heretofore these underground hauling machines which have superseded the mule have been propelled either by electric current or compressed air. The former called for the installation of a trolley system and a generating plant at additional cost, and the compressed air machines also needed auxiliary machinery of no mean dimensions and cost to supply the compressed air. The accompanying illustration shows a self-contained machine of great strength and durability. It is propelled, like any ordinary motor, by the combustion of gasoline and air. But it is, of course, especially constructed for mining use, and has special mechanical devices to make it fitted for its purpose.



A Mine Automobile

One of the greatest difficulties to be overcome was the question of what to do with the smoke and foul gases generated and released by the machine while in operation. Mine workings must be kept free of all noxious gases, and anything which would add to them, say like the ordinary gasoline automobile, would have to be barred. The construction of a special form of muffler, and passing the gases through a liquid, nullifies their poisonous qualities and makes it possible to use such power.

40-FT. PILES TO HOLD SEWER PIPE INTACT

This cast-iron sewer, running through the bed of a stream in which the rush of water following the winter rains tears everything away, is fastened down with 40-ft. piles, incased in cement and sheet iron. For the placing of the piles a well-digging outfit dug 16-in. holes through gravel to a depth of 40 ft. The holes were then lined with a sheet-iron casing, the piles placed, and cement filled in around them.

Anchored Sewer

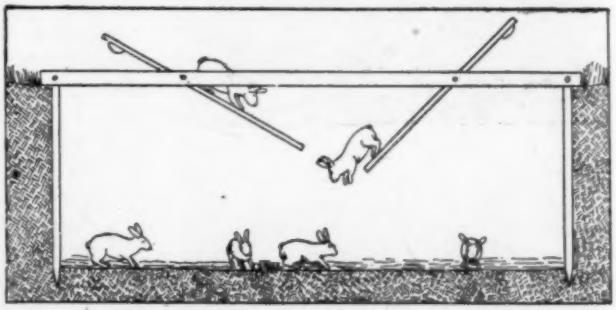
In the same illustration is shown the rock placed on the slope of a railroad bed to protect it against washouts.

NOISY ALARM CLOCK

This alarm clock, with a noise producer made on the same principle as the sounding disc of a telephone, is the noisiest "sleep dispeller" ever made. The moment it commences action all sleep ceases. The only relief possible is to grab it quickly and smother the noise with a pillow. A tube, not unlike the speaking tube of a telephone, takes the place of the bell. At the back of this is the sounding disc, against which a hammer strikes with a reverberating, ear-splitting clatter.

TRAPPING RABBITS IN AUSTRALIA

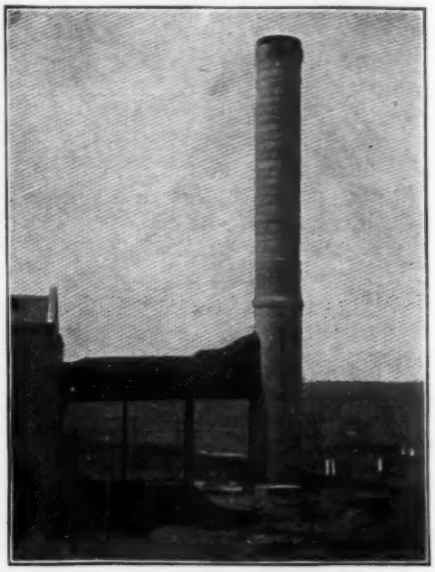
In Australia rabbits are so numerous that they are hunted as pests and destroyed for the protection of crops. Many devices and traps are used to catch them, but none is more simple or efficient than the one shown in this illustration. A pit is dug in the ground along a rabbit-run and two pieces of board, swinging on a pivot, placed over it. As the rabbit strikes the board it inclines and pitches him into the pit, swinging back into position again by the weight at the other end. These traps, which are large enough to hold 100 rabbits, are in common use, are made by the wholesale and sold by hardware and implement dealers generally.



Other death-dealing devices for exterminating the rabbits are the poison carts, which sell for about $100 each, and fumigators, costing $50, for pumping deadly gas into the traps.

DETACHED CONCRETE CHIMNEY

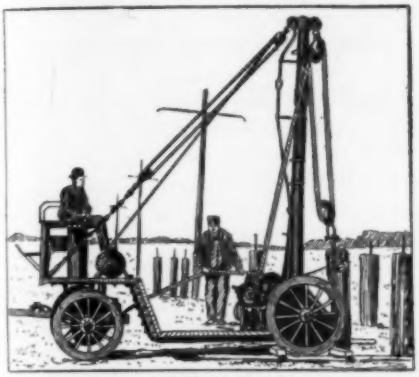
This reinforced concrete chimney, 150 ft. in height, stands 50 ft. distant from the power-house, connected with it by an iron flue. At the point where the flue leaves the power-house its diameter is 13 ft. 6 in. The middle section is 15 ft. in diameter, and at the entry of the chimney it is 23 ft. by 9 ft. The inside diameter of the chimney is 14 ft. No brick lining is used, as the boilers are 100 ft. distant. The fuel is crude oil.



150-Ft. Concrete Stack

ELECTRIC POLE-PULLING DERRICK

Poles sunk to a depth of from 10 to 16 ft. in hard clay can be extracted



A Powerful Puller

in one minute by this electric derrick. The boom is made of a standard 6-in. iron pole, reinforced with a 1-in. truss rod. The pole is fastened to the wagon by a hinged steel fork, arranged so that it can be raised or lowered to suit requirements. The cable drum of the winch is driven by a motor, which gets electric current from the trolley wires.

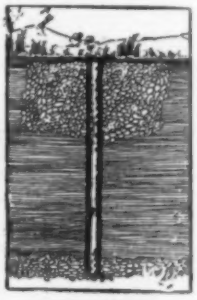
MOVABLE PLATFORM FOR WORK ON GAS TANKS

In riveting large oil and gas tanks with pneumatic hammers an expedient device is used to steady the working platform and support the hammer apparatus. This is a yoke, shaped like an inverted "U." The derrick fastened to it runs on the rim of the tank on grooved rollers. More rollers attached to the inner ends of the platform cross beams make the entire apparatus easy to move around the tank as the work progresses.

Shows Platform in Use

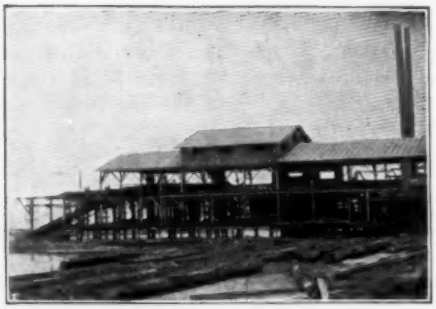
SWAMPS DRAINED BY BORE-HOLES

Of the many methods used for draining swamps, one of the latest is by boring holes to a lower water-bearing stratum, as is often done in drawing off surface water, and allowing the water to drop through the ground instead of pumping it out. The best method of procedure is to select the lowest point on the land to be drained, and drive 6- or 8-in. wrought-iron pipes down to sand or gravel formation. A pit about 3 ft. square is then dug around the top of the pipe and filled with stone and gravel to keep sticks and rubbish from going down the hole. A gravel bed 8 ft. thick will generally take care of a stream of water to the full capacity of the drive pipe.



Swamp Drain

The intense heat in Morocco is one of the hardest conditions the French soldiers have to fight against. When sentries are posted, each guard has to have temporary shelter from the sun's rays.

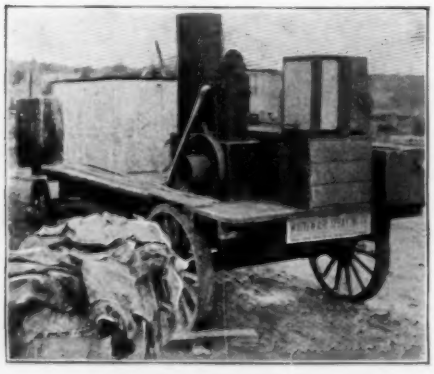


SAWMILL BUILDS ITSELF

The largest sawmill in Southern California built itself, or at least cut its own lumber. The square tumblers of which the framework was constructed formed the center of an immense raft floated down the Pacific from Astoria. Since the picture was taken the mill has sawed the lumber for its sides, and now cuts about 50,000 ft. per day. The latest raft to arrive at the mill was 750 ft. long and 50 ft. wide, containing 4,500,000 ft. of lumber.

WHITEWASH SPRAYING APPARATUS

The old method of putting whitewash on a building with a brush and pail is being superseded by a whitewash spraying machine which does the work as evenly and much more rapidly. The outfit consists of a 2-hp. engine, which operates the pump; a large galvanized tank for whitewash, and 40 ft. of hose.

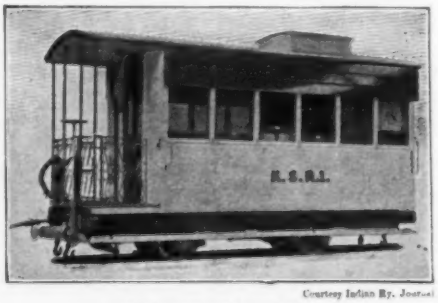


Power Spraying Outfit

The whitewash mixture is often pumped through the hose to buildings 200 ft. away. The moment the work is completed the hose has to be washed thoroughly by pumping clear water through it.

INDIAN INSPECTION CAR

This inspection car, resembling somewhat the street car of medieval times in modern street car service, is rendering fine service on one of the railroad lines in India. It runs over a mountainous road 75 miles long. Instead of being fitted out with all the luxuries found in official cars of this country, which tend toward making inspecting officials think more of the "creature" comforts than the work in hand, it is just 15 ft. long and reminds one of nothing but business.



Courtesy Indian Ry. Journal

Indian Business Car

AUTOMOBILE INSURANCE

Although in writing automobile liability policies the risks are of a "special hazard" nature, a number of American and English companies are assuming the risks of destruction by fire and collision. They also accept a liability of $5,000 in the event of death or injury to one person, and $10,000 for two or more persons.

Just which risks to take and which to leave alone was the hardest problem to face. Automobiles are different from anything else covered by insurance. They are migratory and without permanent place of storage. They

are likely to be destroyed by the burning of a garage, by self-ignition, or by explosion while on the road. The driver may be careless and run down people, the damages for which must be met by the insurance companies.

The prevailing rate of premium is based upon the horsepower of the car. The annual premium on a gasoline 20-hp. car would be $40, and for a steam car of the same power $60.

LICENSING OF MOTOR BOATS

The contention of the U. S. government that gasoline boats engaged in carrying passengers and freight for hire on the navigable waters of the United States must be licensed if over 5 and under 20 tons, and licensed and enrolled if over 20 tons, has been upheld by United States District Judge Anderson, of Indiana. The decision was rendered in the case against the gasoline boat "Messenger." This boat is over 15 gross tons. All boats of over 5 tons must submit to inspection regulations just the same as steam vessels.

WOODEN MOLDS FOR CONCRETE SEWER PIPE

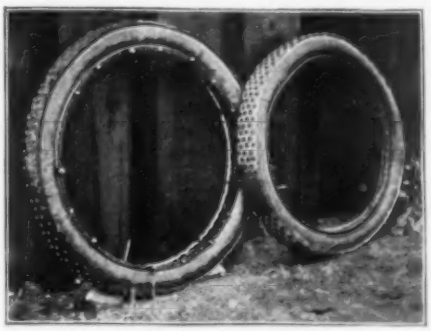
An interurban railroad, having a long stretch of sewerage to construct, built the molds and made its own pipe. The outer sections of the molds were held together by four bolts. The inside mold was built of two semicircular sections held apart by a beveled piece of wood 5 in. in width. The concrete pipes constructed were 3 ft. inside drain by 3 ft. long. The body of the pipe, 6 in. thick, was made of a very wet mixture of 5 bags of cement to 8 of gravel, requiring very little tamping. Four men mixed and filled four molds a day.

Pipes are 6-In. Thick

The pipes shown in this illustration were tested by placing 6,000 lb. of cement in sacks on each pipe.

LEATHER AUTOMOBILE TIRES

A tannery and factory have been erected in California for the manufacture of leather automobile tires. These two tires, one of which traveled over 1,000 miles, are samples of the product. The leather next to the inner tube is specially tanned to require no oil. The outer leather tire is oil-tanned.



Leather Covered Tires

PHOTOGRAPHS AT $1,000 EACH

Ten years ago photographs at $20 a dozen were considered extravagant. Today photographs at $100 each are quite common, and one photographer has just constructed a camera with which he expects to take $1,000 photographs.

These photographs are to be life-size prints, and the camera which is to take them is in reality an entire room, the black walls, ceiling and floor of which correspond to the box of the ordinary

camera. The lens, placed in a tube through the center of one of the walls, can be moved backward and forward to get the right focus.

The $100 photographs now being made are carbon prints on canvas, and measure 25 by 30 in. The same picture on Japanese paper costs $150.

LONGEST CONCRETE BEAMS IN THE WORLD

In the construction of this 10-story concrete building in Los Angeles are embodied a number of exceptional features. The rear of the building, used as an auditorium, has the longest reinforced concrete arches in the world. They have a span of 114 ft. The gallery, also constructed of concrete, overhangs the pillars by 26 ft.

Concrete Spans 114 Ft. Long

The walls, floors and pillars were cast of concrete and the sides of the building facing on the streets were faced with concrete block of 4-in. thickness. The blocks were made of crushed and ground granite. After the building was completed the face of the blocks was washed with a weak acid solution to give an appearance of natural stone. The cost of the building was $500,000.

To make carbon ink dissolve real India ink in common black ink.

NEW WAY TO SHINGLE ROOF

Usually in roof-building the shingles are sawed off at the peak and two thin boards nailed along the ridge. On this roof the shingles were shifted alternately so that they projected on opposite sides. By this method a cheap and ornamental roof peak was made.

OBSTACLES SURMOUNTED BY WIRELESS IN ALASKA

Remarkable as a practical achievement in wireless telegraphy is the installation and maintenance by the United States army corps of a wireless communication across Norton sound, Alaska, making possible an uninterrupted telegraphic connection between Nome and St. Michael.

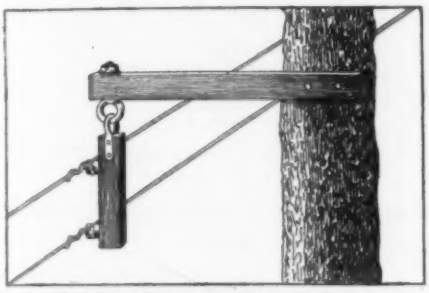
Because of the ice it was found impossible to lay a cable across the sound, and the absolutely barren and snow-swept nature of the coast made an ordinary land line around it impracticable. To successfully establish communication the signal corps found it necessary to build one station upon a glacier and the other upon a coast only accessible three or four months each year. Broken Leyden jars were successfully replaced by air condensers, the spark was muffled, currents shunted and many other improvements necessitated before the communication became satisfactory.

The war and navy departments are now co-operating in this work and in a few months will establish wireless communication between Fort Gibbon and a station to be erected at Valdez and between Seattle and San Francisco. The navy already has several stations in Alaska.

SHOP NOTES

How to Support Telephone Wires on Trees

Sometimes trees are in line with the poles used for constructing a telephone system. A tree may be used instead of a pole by attaching the device as shown in the sketch. A piece of 2 by 4-in. material is spiked to the tree in a



Fastening Telephone Wires to Trees

horizontal position with an eye bolt placed in the projecting end. Suspended from the eye bolt is another shorter piece of wood, to which is attached the insulators that hold the wires.—Contributed by Chas. Lederer, Sr., Pierce, Neb.

How to Make a Truss for a Pipe

A good method of making a truss for a pipe is by fastening rods in a

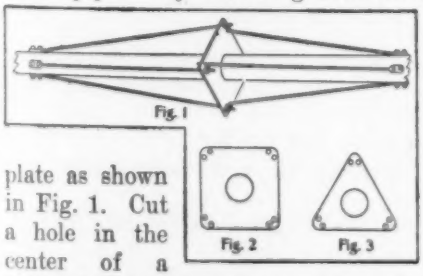
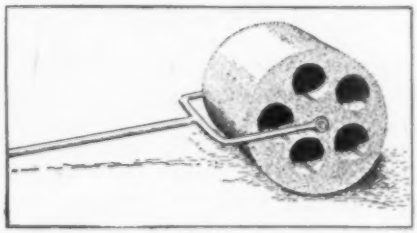


plate as shown in Fig. 1. Cut a hole in the center of a plate of metal a little larger than the outside diameter of the pipe. Drill two small holes in each corner as shown in Fig. 2 for the rods. Place four rods through from each side of the plate and fasten them as shown. If only six rods are wanted, cut the plate as shown in Fig. 3.

How to Make a Concrete Lawn Roller

As solid concrete rollers are too heavy for the purpose, follow out these instructions and you will have a satisfactory article: Saw out a board with a diameter of 22 in. as a form. Bore a hole through the center and insert a piece of ¾-in. gas pipe. Get five lengths of 5-in. stove pipe and fasten them to the circular board form with nails, placed inside the pipe. To set these pipes evenly lay off circles for them first with pencil. Have a tinner roll



Concrete Lawn Roller

and rivet up a light sheet iron drum to fit around the circular board form. Fill concrete in around the five stove pipes and allow to set. If stove pipes are too long they can be easily cut off after the concrete has set. Cut from inside outward at an angle. The concrete must be well tamped in layers about 3 in. thick if a dry mixture is used—that is, a mixture of about the consistency of garden earth.

There are 25,000 gasoline motor boats, large and small, on the lakes and streams of the United States. Many of these are river freighters.

Utility Pipe Wrench

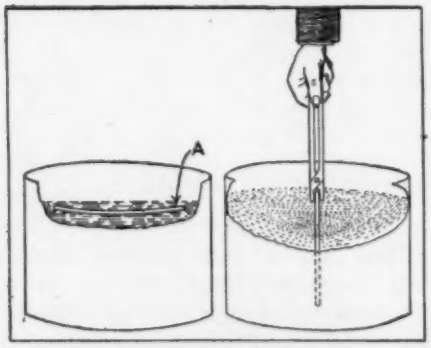
The following description gives a very simple method of turning pipe without tongs or pipe wrenches: Use

Simple Pipe Wrench

a common wrench and a piece of an old round file. Place the wrench on the pipe and set it so as to leave a little space between the pipe and the jaws of the wrench. Place the piece of file as shown and the wrench is ready to turn the pipe. Two wrenches may be used the same as two pipe wrenches by reversing one of them, or using them so as to grip in opposite directions.

How to Temper Thin Steel Without Warping

There is nothing quite so discouraging as to have a piece of steel come from the bath warped out of shape, as it must be annealed, straightened and tempered again. The most trouble comes from too high a heat, and also from moving the piece sideways in the bath, thereby coming in contact with cold water on one side and hot water following up the other side. The side that chills the quickest will be convex, for instance: Place a piece in the bath

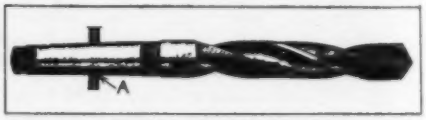


Tempering Thin Steel

as in Fig. 1 and the ends will come up as at A. The same results are obtained if the piece is put down endways and moved about in the bath. Make a bath by adding as much common salt to the water as the water will dissolve. Heat the piece to be hardened at as low a heat as it will harden. This, of course, must be determined by the amount of carbon in the metal. The salt water chills the piece at a lower heat and does not allow steam formation on the body of the steel. When about to dip the piece, stir the water with a stick and make it whirl rapidly and place the piece in endways in the center of the whirling fluid, as shown in Fig. 2, and hold still until chilled sufficiently. Remove the piece and place it in a tank of fish oil and let it remain until cold.—J. F. S.

Round Shank Drills Used in a Hand Brace

A good way to fix round shank drills so they can be used in a hand brace is



For Use in Hand Brace

to drill a small hole through the shank of the drill and insert a small pin, A, as shown in the sketch. This pin will fit in between the jaws of the chuck and cause the drill to turn as well as if it were a tapered square shank drill. The round shank drills are not as expensive as the ones with the square shank.—Contributed by W. E. Turner, Chicago.

Fitting Keys to Door Locks

Secure a blank key and file the end until it will start in the lock. Hold the blank key over a lighted candle or a match until it is well smoked. Place this smoked blank in the lock and try to turn it, and by so doing the part that must be filed out will appear

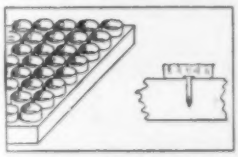
bright when the blank is removed. Repeat this operation several times and a key can be made with very little work.

How to Remove Paint from Tiles

There is nothing more unsightly than spots and splashes of paint left on the floors and tiles of buildings. Most tiles will allow a wash of caustic soda being put over them, which will remove the paint without the necessity of using an after wash of acid to destroy the effects of the potash, water only being required, says Modern Building. But if the tile is likely to stain with the potash, a wash of diluted ammonia will remove the paint spots, which in turn can be washed off with clean water.

Home-Made Door Mat

Secure some patent bottle covers, such as are found on pop and beer bottles, and nail them to a board with the rims upwards. The covers may be placed in rows or laid in some neat pattern. The board used should be about 1 in. thick and can be made in any shape or size desired.—Contributed by J. P. Clifford, St. Paul, Minn.

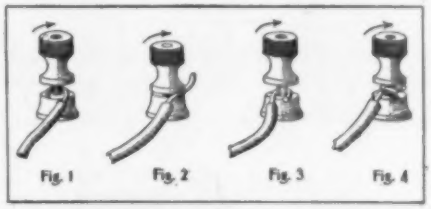


How to Make a Furniture Cream

Cut into small pieces ¼ lb. of yellow wax, melt it and add 1 oz. of well powdered black resin. The wax and resin being melted, pour in slowly, quite warm, 2 oz. of oil or spirits of turpentine. Keep in a covered tin or earthen vessel, says The Furniture Journal. After the furniture is well dusted and cleaned this mixture may be applied by spreading a little on a woolen cloth and rubbing the wood with it. In a few days the gloss will be as firm and fast as varnish.

Connecting Wires to Binding-Posts

The accompanying sketch shows the incorrect and the correct methods of attaching wires to binding posts. In

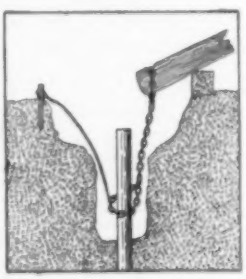


Attaching Wires to Binding-Posts

Fig. 1 is shown the manner in which through carelessness the wire is given a turn in the wrong direction, which will cause it to straighten out when the nut is turned down, as shown in Fig. 2. In Fig. 3 is shown the correct way to turn the wire in the direction the nut turns on the post. When the nut is turned down in this case the tendency is to wind the wire around the binding-post (see Fig. 4) instead of spreading it.

Removing a Chain Grip on a Pipe

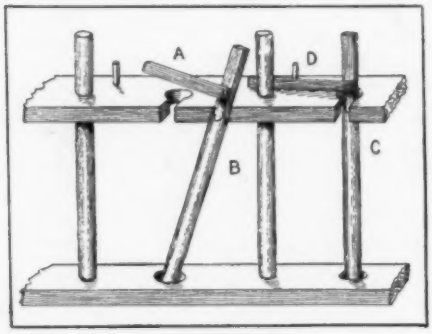
Sometimes when a pipe is driven for a shallow well it is found that the point has been placed too deep for a good supply of water and in order to lift it a few feet a chain with a loop is placed around the pipe and around the end of a long lever, as shown in the sketch. The hole about the pipe is generally too small to allow a person's hand to loosen the grip of the chain when the pipe has been lifted to the proper place. As the chain is given slack it slips lower on the pipe and grips a new hold. To remove the chain when desired, fasten a piece of wire in the loop on the opposite side



from where the chain pulls and by holding this wire and giving the chain slack the loop may be taken off the pipe.

How to Make a Cattle Stanchion

A cattle stanchion that is easily operated and will stay in place when set

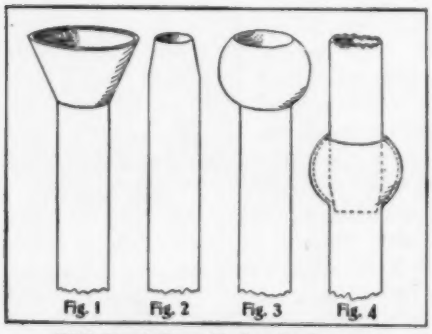


Easily Operated

is made as shown in the illustration. The post B is placed in position by turning the small lever A so the square or thin part of the post B will enter the notch. The small lever A is then turned as shown in the second position, C, and the pin D inserted.

How to Make a Soldered Joint

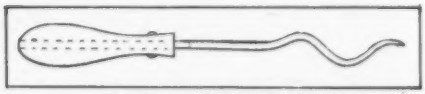
The accompanying sketch shows how to make a soldered joint that will stand more hydraulic pressure than the ordinary wipe joint. Anybody who can use a plumber's torch can make this joint, and if considerable care is taken, it may be done with a soldering iron. Prepare the end of one lead pipe as shown in Fig. 1 by using a tampion. Make the opening as wide as possible. Clean the inside as far as it has been opened and close the end by using a dresser or flat piece of wood until it is the shape shown in Fig. 3. Rasp down the end of the other lead pipe, (Fig. 2) and clean it all around with a knife for the length of about 2 in. Place the ends of the pipe together as shown in Fig. 4 and pour in the melted solder. The pipes should be heated before turning in the solder so as to make them tin well.—Contributed by R. Doyle, New York.



Will Stand Great Hydraulic Pressure

A Quickly Made Furnace and Stove Poker

The accompanying sketch shows an easily made furnace and stove poker.



Furnace and Stove Poker

For furnace use, make it of $\frac{1}{2}$-in. round iron and 36 in. long, says the American Blacksmith. For stove use it may be made of $\frac{3}{8}$-in. round stock and 20 in. long. The handle may be made of any wood stock and bolted or riveted to the rod as shown.

Brazing Compound for Steel

The following formula makes a good compound for brazing steel and when the brazing is completed but little filing is necessary, as the scale formed is very loose:

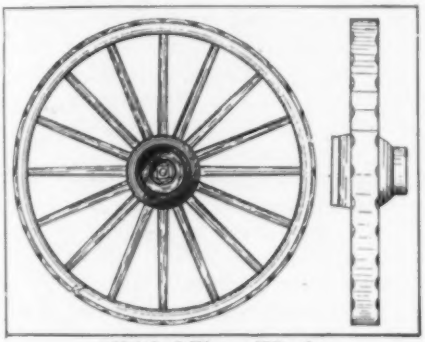
Boracic acid..... 3 parts by weight
Borax powdered ..... 1 part by weight

The borax must be calcined or melted before mixing. Use a ladle in melting the borax, and after it cools reduce to a powder. Mix with the acid and apply as a paste with water.

To keep the spelter from flowing over parts of the steel where not wanted coat them with a mixture of graphite and thick oil or grease.—Contributed by J. M. Derr, Shortsville, N. Y.

To Make Wagon Wheels Climb Car Tracks

The accompanying sketch shows how to fix wagon wheel tires to prevent the wheels from gliding along street car tracks when crossing at an angle, or climbing out when driven parallel with them. Make notches about 6 in. apart on both sides of the tire by using

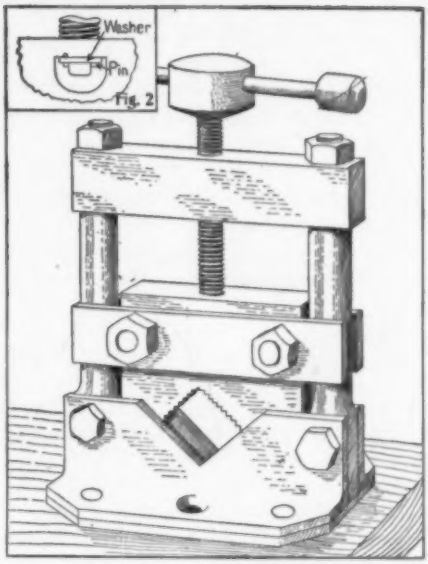


Notched Wagon Wheel

a 14-in. half-round file. The notches striking the rail will at once cause the wheel to climb and cross it.—Contributed by W. C. Wefel, Denver, Colo.

A Home-Made Pipe Vise

The accompanying sketch shows a pipe vise constructed from scraps and made by a correspondent of the Model Engineer, London. It consists of an iron base, to which are riveted two angle irons. To these angle irons is bolted on each end an upright, as shown. The uprights have a shoulder turned on the top to carry the cross-piece or yoke. The yoke is held down by nuts screwed on the turned portion of the uprights. The top jaw is a piece of iron drilled to take the bolts that secure the guiding strips on each side. The guiding strips cover the hole in the top jaw. This hole, which



Pipe Vise Made of Scraps

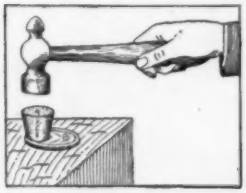
is first drilled and filed out, Fig. 2, is to admit the washer put on and the pin through the end of the screw. This arrangement is to enable the top jaw to be lifted by the screw. The screw is a round-headed bolt turned down to $\frac{3}{8}$ in. and tapped. The bottom end is turned to $\frac{1}{4}$ in. to pass into the top jaw, as shown in the sketch, Fig. 2. The handle is a steel rod with two iron ends screwed on as shown. The gripping portion of the top jaw is filed to make teeth and afterwards case-hardened.

Home-Made Bit Gauge

A simple yet effective way to bore a hole to a certain depth in a board is to make a hole the size of the bit in the center of a common cork. Place this cork on the bit as shown in the sketch at a certain place and several holes may be bored to the same depth. In boring a number of holes do not allow the cork to touch the board, as this may change its position.—Contributed by Henry R. Bowman, Freeland, Md.

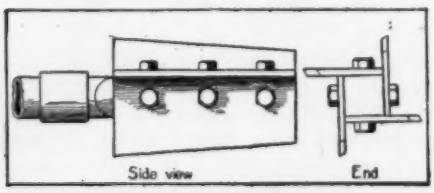
How to Produce a Minute Hole in Metal

Although not of much practical value, but as a trick it may be interesting to know how an exceedingly small hole may be made through a medal or other metal that may not be too hard. On the end of a block of hard wood, the fiber being in a vertical position, lay the medal or other metal. Take an ordinary bottle cork and a fine but straight sewing needle, run the needle lengthwise through the cork from the top and far enough so the point is just visible underneath and no farther. Give the needle a slight kink at the top, thus snapping it off even with the surface of the cork, says the Woodworkers' Review. Stand the cork on the metal to be punctured, with the point of the needle downward, and strike a moderate blow with a hammer squarely on the upper end of the cork, and the needle will instantly be driven through the metal, where it can be removed by a backward blow, thus leaving the minute hole, as desired.



How to Make a Locomotive Exhaust Nozzle Reamer

The accompanying sketch shows how to make a reamer for cleaning the exhaust nozzle of locomotives without opening the front end. The reamer is fastened to a long 1-in. pipe with a tee at the end through which a bar is placed to turn the reamer, and is then placed in the exhaust nozzle through the stack. It may be made of such a size that the reamer will fit all the exhaust nozzles on the engines running on the division.—Contributed by W. W. Updegraff, Fruitvale, Cal.



Exhaust Nozzle Reamer

Making Concrete in Freezing Weather

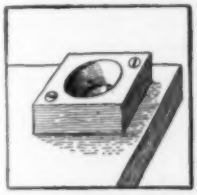
Concrete may be mixed and placed during freezing weather with perfect safety provided that certain precautions are taken. In mass work, where only light loads will come upon the concrete until such time as it has an opportunity to thaw out and reharden, no precautions need to be taken to prevent freezing. In cases where freezing must be prevented until at least the initial set has taken place, three different methods may be used, separately or in combination, viz.: First, the concrete aggregate may be heated, or hot water or steam may be used in the mixing, which will hasten the set; second, sodium chloride, calcium chloride or other chemicals may be added, so as to lower the freezing point of the water; third, the work may be inclosed and the interior of the inclosure maintained above a freezing temperature until the concrete sets naturally.

The heating of the aggregate is always advisable so as to preclude the possibility of frozen lumps of sand getting into the completed work. When boiling hot water is employed, the mixing process does not usually occupy enough time to thaw out the frozen lumps, even of small size. The sand or other material should always be heated. It is always best to heat the water also, says the Concrete Review. A small expenditure will cover the cost of the apparatus necessary for this purpose, and the fuel bill is relatively small. If steam is employed for this purpose, it will be found quite profitable to lead a pipe or hose to the point of deposit and heat and clean the forms, and the reinforcement, if used. For mass concrete work the use of chemicals added to the water may be advisable where

the temperatures do not fall much below the freezing point. Common salt used for this purpose has shown good results in several experiments, and no detrimental results in actual work.

A Draftsman's Ink Bottle Holder

Draftsmen and students of home study schools will appreciate the little device here illustrated. As few drawings are made the full size of the drawing board, this ink bottle holder can be attached to the upper right hand corner of the board, leaving a little space from the edge when necessary to place the board in a rack. The holder is made from a $\frac{7}{8}$-in. thick board, $2\frac{1}{2}$ in. square, with a hole cut in the center $1\frac{13}{16}$ in. in diameter.—Contributed by C. E. McKinney, Jr., Newark, N. J.



How to Sharpen Dentist's Tools

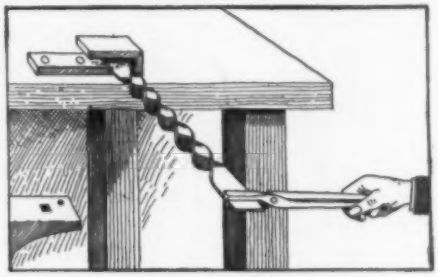
Place the points of the tools in nitric acid for about two seconds, remove and immediately dip in water. Examine the edges under a magnifying glass and if they are not sharp, repeat the operation. When the tools are sharpened they can be polished with a tooth brush and some metal polish.

Tempering Self-Hardening Steel

Self-hardening steel was used for drills on a certain class of work where they had to be run with great speed in order to make time. As some castings were quite hard, the drills would not do the work running at high speed. The drills were heated to a dull red and driven into a chunk of lead for about $\frac{1}{2}$ in. and left to cool. The drills treated in this manner retained their cutting edge well on hard castings. The steel must not be heated too hot, as this will cause it to crumble.—Contributed by W. J. Vrooman, Lake Geneva, Wis.

How to Form Coal Drills

Coal drills may be given the proper twist with ease and rapidity by using a piece of metal formed in the shape shown in the sketch. The device is made from $\frac{3}{8}$-in. by $1\frac{1}{4}$-in. material



Turn with Tongs

which is fastened to a bench or other suitable support near the anvil. The material for making the drills is heated and one end placed in the hook while the other end is turned with the tongs.—Contributed by John Mikesell, Des Moines, Iowa.

Saving a Hack-Saw Blade

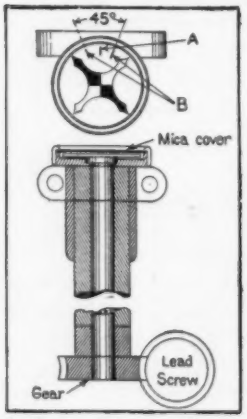
Most machinists have doubtless noticed that when one or more teeth break from the blade of a hack-saw others will soon follow. This is especially true when the piece being sawed is narrow, says Machinery, as the saw drops when the space made by the broken teeth passes over the work. Other

Saving a Hack-Saw Blade

teeth can be prevented from breaking by grinding two or three teeth on each side of the broken part, as shown by the dotted line in the cut. This will prevent the teeth which are next to the broken part from striking abruptly against the work.

Screw-Cutting Indicator for Lathes

Anyone working with a lathe knows that in cutting threads it is necessary to stop and reverse the machine, allowing it to run backward in order to make the carriage return to the exact place for the tool to take the next cut. The indicator described and illustrated in this article can be attached to the lathe carriage so that the small gear of the device will mesh with the lead screw of the lathe, which will cause the indicator to show the point where to place the tool each time without returning the carriage by reversing the machine. It consists of a mica covered dial under which revolve four arrow points, each point having a different color. This arrow wheel is attached to a shaft which is turned by the small gear. Three marks are made on the dial, as shown at A and B, and by referring to the following five rules the tool may be set at the exact place by returning the carriage by hand:



1. For cutting any even number of threads per inch, not fractional, close the nut on the lathe screw with any arrow under either line B on all cuts.

2. For any odd number of threads per inch, not fractional, close the nut on the lathe screw with any arrow under line A on all cuts.

3. For any number of threads per inch containing the fraction ½ close the nut on the lathe screw with same colored arrow under line A on all cuts.

4. For any number of threads per inch containing the fractions ¼ or ¾ close the nut on the lathe screw with the same arrow under line A on all cuts.

5. All threads which are multiples of the lead screw thread can be caught at any point.—Contributed by W. C. Deibert, Clifton Forge, Va.

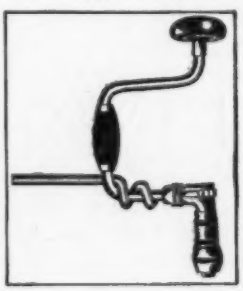
How to Mix White Lead

When a keg of white lead has stood for some months the lead becomes denser, owing to the soaking away of the oil into the wood. It is more difficult to work up into a smooth paint when in this condition, although it may have improved in quality. To remedy this to a great extent, take a stout, narrow paddle and put it into the lead until it strikes the bottom of the keg, then work the paddle back and forth from side to side for a few times, and the mass will soon become quite plastic, and then it may be removed into pots for further breaking up and thinning for use. This will save much time over the usual way of first taking the lead out of the keg and breaking it up in the pot, says The Master Painter.

White lead should always be beaten up before adding thinners, and then the japan should be added and well beaten up with the lead. If possible let the mass stand a few hours and then the thinners may be added to the desired amount. This will render the straining of the paint unnecessary unless the skins are present. If colors are to be added, beat them up separately and thin out so that they will unite readily with the paint.

An Extra Handle for a Hand Brace

While boring some holes through a hard maple floor I found it such hard work that it was almost impossible to accomplish the task. I conceived the idea of attaching a handle on my ratchet brace in some manner. The accompanying sketch shows



how the handle was made to attach to the brace by turning it on like a screw.—Contributed by A. Mueller-weiss, Sebewaing, Mich.

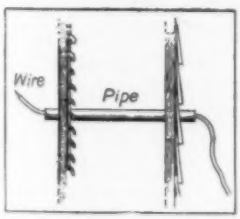
Wind Pressure per Square Foot

From the tables compiled by the United States Weather Bureau the wind pressure per square foot is as follows, according to the velocity of the wind per hour:

10 miles... .37 lb.	50 miles... 6.66 lb.
20 miles...1.27 lb.	60 miles... 9.22 lb.
30 miles...2.64 lb.	70 miles...12.05 lb.
40 miles...4.44 lb.	80 miles...15.50 lb.
90 miles...19.20 lb.	

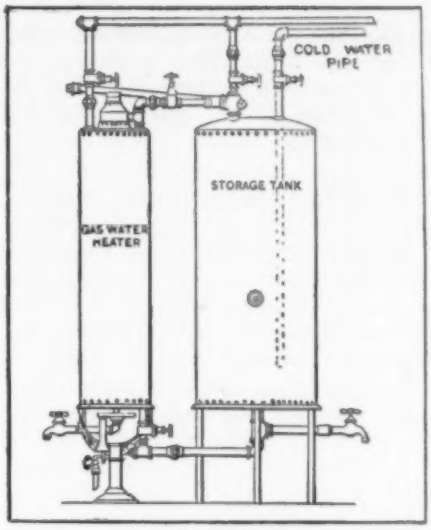
To "Fish" Electric Wires Through Walls

Electricians often experience difficulty in "fishing" wires through drilled holes, and especially if there is an intervening space: a hollow wall for instance. This trouble may be overcome by first inserting a piece of tubing or pipe—long enough to reach through both holes. The wire then may be pushed through this tube and the latter withdrawn. A tube or pipe having a $\frac{5}{16}$-in. hole and 2 ft. long will do for general work. For bell wires a smaller one may be used. This little device will prove a time-saver for the electrician.—Contributed by W. J. Travers, Buffalo, N. Y.



How to Store Hot Water

At the last meeting of the Pacific Coast Gas Association a method was discussed for storing hot water in connection with a kitchen boiler supplied with heat from a gas burner. In the accompanying sketch is shown the combination of this boiler connected to a larger boiler in which the water is stored. The arrangement is suggested as one already being used in apartment houses where, for example, a 200-gal. storage tank is connected to two boilers, furnishing hot water for fifty basins, four baths and wash trays. The boilers were installed after oil burners and coal heaters had failed to give satisfaction. It will be seen that the hot water from the gas heater can be delivered directly into the hot water service pipe, or it can be sent to the storage tank alongside, valves being provided in both of these delivery pipes. Naturally it will require that the user understand the scheme of the connections, else the case might happen when all the water pipes to and from the heater were shut off by the valves, with the result that when heating is begun there will be an expansion of the water, the development of a dangerous pressure and bursting of the tank. It will be seen that the cold water supply is brought to the storage tank, and that a pipe leads from the storage tank to the hot water heater. Sediment cocks are provided for both the storage tank and the gas heater. Above the gas heater is a so-called vent cap discharge for the products of combustion from the gas burner, which is shown below the boiler with an air mixer. Behind the pipes of the gas-heated boiler will

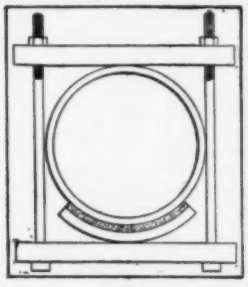


Hot Water Storage

be seen a pipe slanting upward from the storage tank. This is to indicate how a pipe from a second heater would be connected to the cross at the top of the storage tank.

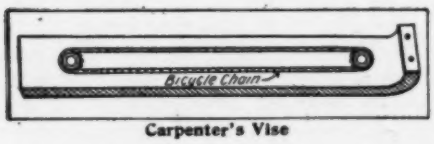
How to Repair a Leaky Pipe

When a pipe bursts or springs a leak, the usual way is to shut the proper valve, and after taking the size and length of the defective part, replace it with a new piece. This plan works well where there is plenty of time, but sometimes time is valuable, says a correspondent in Engineers' Review. An arrangement can be made quickly to assist in such cases which will give good service for several years. The device can be briefly described as a clamp. It is made of flat iron having a thickness of $\frac{5}{16}$ in. and varying in width, according to the size of pipe for which it is intended. One piece of iron must be bent to fit on the pipe and a piece of packing placed between it and the pipe and over the break, as shown in the illustration.



How to Make a Carpenter's Parallel Vise

The accompanying sketch shows how to construct the outside jaw of a carpenter's vise so as to have a square jaw for the work at all times. Fasten to the screw that opens and closes the vise, the small sprocket wheel that is used on a bicycle, say about 12 teeth. At the bottom of the vise another screw and sprocket wheel is fixed in the same way. The number of sprockets should be the same on both wheels. These two sprocket wheels are connected with a common bicycle chain, so that when the top screw is turned by means of the handle, the bottom screw turns also, says a correspondent in Modern Machinery. This will cause the outside jaw to open and close in parallel with the one attached to the bench.



Carpenter's Vise

Drilling Large Holes with a Small Bit

Some 9-in. holes had to be drilled for steel anchor posts for a railroad company along the lakes and the contractor had 5-in. bits, only. He did not care to change his bits to 9 in. in order to make the few holes, says a correspondent in the Drill Hole. The holes were to be 23 ft. deep—15 ft. in dirt and 8 ft. in bed rock of massive bedded shale. A 12-in. hole was dug with a spade to the depth of $1\frac{1}{2}$ ft. Owing to the play the tools had above, it was easy to spud the sides of the hole down nearly straight, but as the anchor posts had to fit pretty snug in the shale, the hole was tapered from the top so that when the shale was reached the hole was reduced to 10 in. The hole was started in the shale at 10 in. and the swinging of the top of the tools in the 12-in. opening enabled the operators to carry the hole down at a diameter between 9 and 10 in.

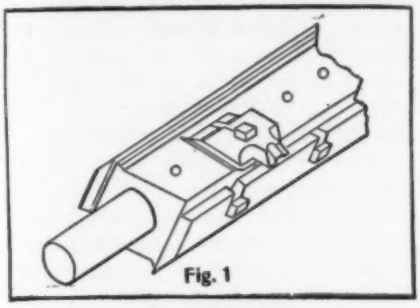
It was found necessary to keep perfectly square corners on the bits and to keep the top of the tools moving so that the bit cut full size of the hole.

In drilling the holes 4 ft. of lake sand was struck which was mixed with water sufficient to make it run like quicksand. Some good stiff clay was procured and chopped up fine and dumped in the hole, with the addition of enough water to make a nice thick batter. By keeping the batter at the right thickness the tools were put in and no trouble was encountered in reaching bed rock. The only thing that had to be guarded against was to keep from getting too much water in the hole at one time, as an excess of water

washed the clay from the sides of the hole and let the sand run.

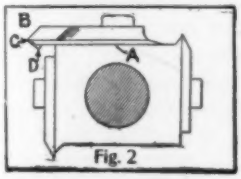
Beading with a Planer

It often happens, particularly in the jobshop, that a bead of some kind of a



Beading Tool

light moulding shape is required near the middle of a wide board. It is quite

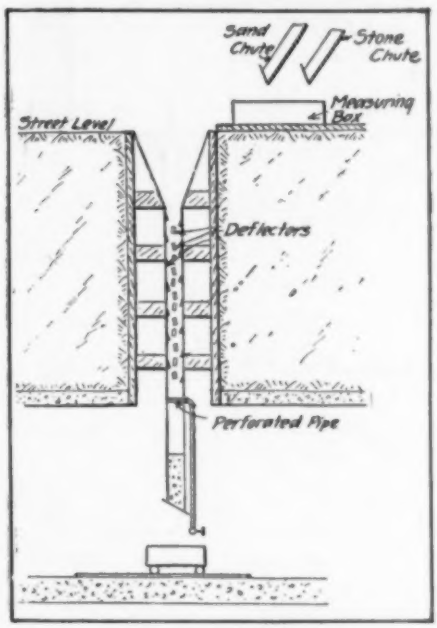


a task to set up a four-side machine just for a 1-in. strip down the middle of ten or eleven 10-ft. boards, and if the job could only be done on the double surfacer it would be a great convenience. For this purpose a correspondent in Woodcraft designed the little device which is shown in Fig. 1. Briefly stated, it consists of a cutter of the required shape to do the work, an adjustable chip breaker placed underneath the little cutter, and a bolt for holding the cutter in place. Several holes along the head are provided for fastening the beader in place anywhere along the length of the cutterhead. The chip breaker is shown at A and the cutter at B, Fig. 2.

The proper arrangement of beader cutter and its chip breaker is more plainly shown in Fig. 2, in which the end or sectional view of the cutterhead is presented. In this sketch the cutting portion of the tool, B, is shown projecting from circle C to circle D; the distance radially between those two circles will be the depth to which the beading tool will cut.

How to Make a Gravity Concrete Mixer

The accompanying sketch shows a simple gravity mixer which was used in mixing the concrete for a tunnel lining. The arrangement was placed in a shaft and consisted of a hopper connected to the top of a vertical 12 by 20-in. rectangular chute. At intervals of 24 in. inclined baffle plates made of iron plates and wooden backing blocks were placed in the chute. The baffle plates were staggered on opposite sides, those on two sides of the chute being set at an angle from the vertical and the spaces between them interrupted by through bolts which served to deflect and displace the falling materials. About 16 ft. from the top, water was admitted to the chute through two horizontal pipes controlled by a valve in the bottom of the tunnel. The chute



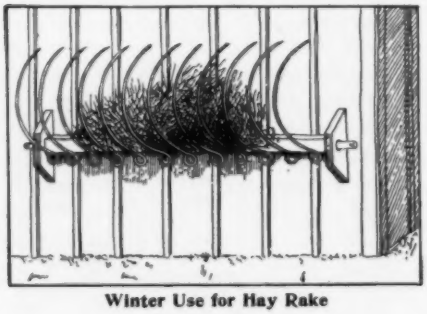
Gravity Concrete Mixer

was about 30 ft. long and had its lower end closed by a balanced valve, says Engineering-Contracting. The sand and broken stone were drawn from bins through chutes into the measuring box, which had neither top nor bottom, but

rested on a smooth floor. The box was filled and leveled to the required height with broken stone, the required amount of sand was then added, and the cement placed on top. The box frame was then lifted and the mass shoveled into the chute. About 1 cu. yd. of concrete was mixed at a time.

Quickly Made Feed Rack

During the winter months the hay rake may be put into service as a feed rack by attaching two blocks of wood, which have holes bored in them to receive the axles of the rake, to the wall

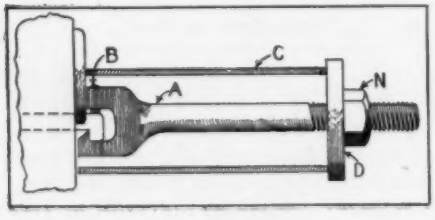


Winter Use for Hay Rake

of a shed or barn, as shown in the illustration. In many cases it is better to have the rake used in this manner than to be standing in the field.—G. McV.

Handy Tool for Removing Keys

Make a hook on one end of a piece of cold-rolled steel, as shown at A in the sketch, and thread the other end for a nut. A small set screw, B, is fitted in the hook end with its head flush with the metal, which serves to hold the hook in place when in use.



A tube, C, is cut to the proper length and fitted with a washer, D, through which the end of the hook, A, is inserted and the nut placed in position. Turn the nut and the key will be removed with ease.

Repairing a Worn Lathe Lead Screw

The lead screw on a lathe became worn so that it had to be replaced with a new one or repaired in some way. A plan was devised to make the old screw larger and recut the threads. The screw was taken out and cleaned from all oil and grease and laid on a piece of sheet iron. After putting some clay around the screw it was placed in the fire and spelter melted and run in the threads. It was taken from the fire while hot and the surplus metal removed by wiping with waste. A part of the threads were left at one end without being brazed on, which was to adjust the die for recutting the threads. The die was run over the screw, which made it as good as new.—Contributed by Frank G. Lilja, Indian Orchard, Mass.

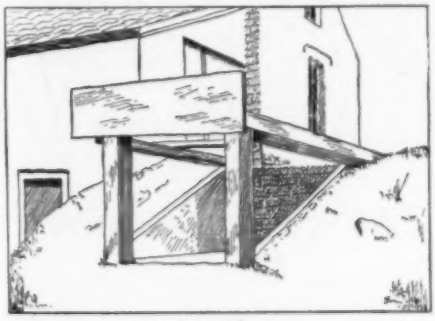
Floors for Erecting Shops

Floors with a top wooden surface are much to be preferred, as they are more agreeable for the men standing upon them. This floor, however, must be protected from rot by a proper substructure. A recent specification called for the ground to be well tamped to a level 14 in. below the finished floor line and then covered to a depth of 6 in. with broken stone, the voids being filled with small stones and the whole being well rolled or rammed into place. This surface was to be liberally covered with hot coal tar, and after setting it was to be brought to a level by 1 in. of sand and tar, the sand being heated and thoroughly incorporated with a mixture of two parts of coal and one part of coal tar pitch. On this were to be placed 3 by 4 in. yellow pine zinc-treated sills, the spaces between the sills being filled

with tarred sand and packed while hot to a level with the top of the sills. Over this was to be laid a course of 2¾-in. treated yellow pine, this being covered with a layer of roofing felt, and finally a course of 1¼-in. hardwood boards. While such floors are expensive they are very permanent, and we have heard of cases where they have been in use for 20 or 30 years.—George R. Henderson, of New England Railroad Club.

Quickly Made Automobile Pit

Constructing the ordinary type of dugout automobile pit is an undertaking that the average autoist hesitates to tackle. A substitute pit is easily constructed by the amateur as described by a correspondent in Autocar. It is constructed, as may be seen from the sketch, as a sort of pier off the hillside. It can be easily protected by a light roof if desired, and when so covered it would be very light to work in, even in dull weather. The rails are 12 ft. long, 11 in. wide between the raised edges and 4 in. thick. The track is about 3



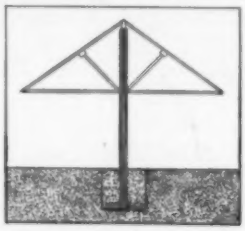
Automobile Pit

ft. inside measurement and 5½ ft. outside. The track is about 4½ ft. above the pit floor at the outer end of the rails. The pit is 9 ft. long and 4½ ft. wide and paved with cement. The supporting uprights at the outer end of the track are 10 in. in diameter.

A French invention, consisting of bulb thermometers, predicts at sundown whether there will be a frost.

How to Make an Umbrella Shed

A large umbrella shed was constructed at Pier 36, North River, New York, for the purpose of temporary storage and used especially for produce for the city markets which it handled daily. In building this shed it was considered necessary to avoid obstruction by columns along the side, and the structure was made with a light roof carried entirely by a single row of vertical columns 20 ft. apart. The floor space was paved with asphalt, in which six 4 by 4-ft. pits were excavated to a depth of about 5 ft. Vertical posts 10 by 10 in. and 25 ft. long, with cross-pieces 10 by 10 in. and 6 ft. long, bolted to their bottom ends, were placed in these holes. These cross-pieces were thoroughly bedded, and the hole entirely filled with concrete. These posts were carefully plumbed and served to carry the entire superstructure. At their upper ends they are connected by a 3 by 10-in. mortised ribbed purlin which supports the trussed rafters.



Each truss is a triangular framework of 2½-in. screwed steel pipe, 2½ in. in diameter for the top piece and 3 in. in diameter for the bottom. The truss has a depth of 8 ft., and each side of the top piece, or each rafter, is a single length of pipe fitted at the upper end with an oblique screwed flange. The flanges of the two connected pieces are bolted together through the top of the post. The lower end of the top piece is screwed into a casting into which there is also screwed the end of the bottom pipe, which at the opposite end is also flange-connected to the vertical post through which it is bolted. The castings at the ends of the bottom pipes also received the screwed ends of horizontal eaves struts of 2½-in. pipe which support the intermediate rafters of 2 by 6-in. timbers 4 ft. apart with loop con-

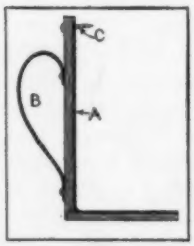
nections of flat iron engaging the struts. The upper ends of these rafters are mortised in the usual way into the ridge purlin. Half way between the ridge and the eaves purlin there is a 2 by 6-in. intermediate purlin supported by a bent strap engaging the top pipe of the roof truss.

The framework thus provided is covered with a continuous sheet of paraffined heavy canvas with transverse breadths sewed together sail fashion to make one large sheet or tarpaulin. The side walls are formed of vertical curtains of the same material mounted on rollers at the eaves strut, which may be rolled up and give an entirely clear opening under the roof, says the Engineering Record.

As the structure is very light and may be exposed to severe wind, extra bracing is provided by four inclined 4 by 5-in. struts, radiating from the intersection of the vertical post and its lower pipe to the intermediate purlin, where they are knee-braced to secure stiffness and transmit the possible stresses on the main rafters.

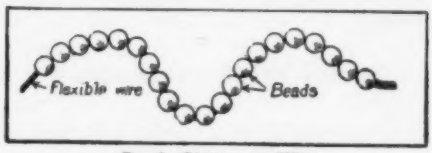
Home-Made Flash Sheet Holder

A great many persons use flash sheets for making interior views or night pictures. The usual method is to tack the sheet to some piece of furniture or doorcase. The accompanying sketch shows how to make a flash sheet holder that is not only convenient but can be held in any position desired. Secure two thin boards, both 4 in. wide, one 8 in. and the other 3 in. long. Fasten these together with brads forming an L-shaped object. Line the inside part, A, with thin metal and insert a small nail, C, leaving a part of the nail projecting on the metal side, which is used to hold the flash sheet. A handle, B, is formed from the thin metal and attached to the back side.—Contributed by Ralph Farnham, Cleveland, O.



Glass Beads Make Good Insulation

While recently engaged in the construction of electrical projective apparatus, which required a flexible electrical conductor, to be used under comparatively high temperatures, we discovered that the ordinary rubber insulation soon melted and thus allowed the flexible wire to make a "ground" on the metallic frame of the machine. We had about decided to use mica washers with asbestos separators, when we were advised of a much cheaper method, and one which answers the purpose perfectly.

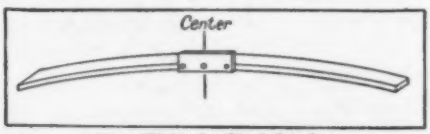


Beads Strung on Wire

We simply strung a number of glass beads on the wire, as shown in the sketch, thus giving it a high insulation without impairing its flexibility. We are under the impression that the same scheme is used in certain arc lights, but it will probably be new to some readers, as it was to us.—E. D.

How to Make a Sign Writer's Straightedge

Dress a lath true and thin. Make a hand hold out of a piece of board $\frac{1}{2}$ or $\frac{3}{8}$ in. thick and about 6 in. long. Find the exact center of the lath and the hand hold and drive a nail so as to meet both centers. Bend the lath to a slight bow and drive two more nails, one at

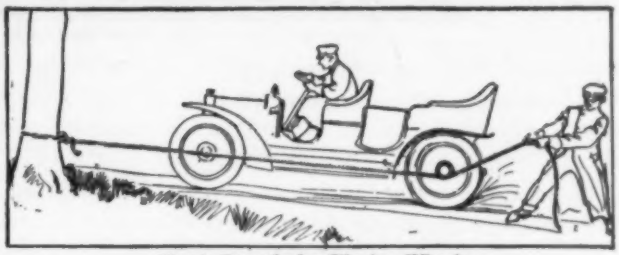


Sign Writer's Straightedge

each end of the hand hold. When this straightedge is placed for striping, or penciling lines of any kind, it will not slip when held with one hand.

A Method to Make Slipping Automobile Wheels Pull

When the wheels of a car slip for lack of traction, as in the case of a muddy surface on a grade, or a deep mire, then it is that the average motorist looks about for some assistance. If a rope is at hand it may be placed around the hub of one of the driving wheels in the manner of a hoisting drum, wrapping it with a turn or two, one end of which is attached to a tree or any other convenient solid object in front of the car. Using the low gear, and with someone to maintain a tension on the rear end of the rope, an enormous pull is secured, which is certain to uproot something. The rope must be applied to the wheel that spins most freely, the differential action usually causing one to hold while the other slips, says Motor Age. When no tree or other attachment for the rope is available, a stout stake may be driven in the ground.



Simple Remedy for Slipping Wheels

How to Paint Iron, Zinc, Etc.

The time for painting new iron is at the foundry as soon after casting, or being wrought or rolled, as possible, says The Master Painter. Do not paint it in the early morning or damp evening but when a dry wind or warm sun will act upon it. See that the iron is thoroughly dry and free from rust, and then coat with red lead and linseed oil a thin coat, just enough to penetrate the pores of the iron. The first coat must dry hard. Follow up with three other coats containing red or white lead in as great proportion as possible.

To paint old iron, burn off all rust and scale, brush with turpentine or paraffin and proceed precisely as with new iron.

For zinc, the first coat should consist of white lead, red lead and turpentine, tempered with varnish. Wash new rolled sheet zinc with a solution of a tablespoonful of hydrochloric or nitric acid to a gallon of water, or scratch the surface with No. 2 glass paper before painting.

Treat galvanized iron the same as zinc, but do not use the acid preparation, nor scratch. Very smooth, bright tinplate must be first dulled or scratched and the first coat should be oilless.

A Short Method of Testing Electric Circuits

In testing out electric circuits the following method is sure and simple: Twist the ends of the line together and attach two double-bladed knives to the terminal wires of the test box by closing the large blade of each knife, one on each wire. Open the little blades and cut through the insulation close to where the connections are made to the main line and test. The bell will ring when the work is done properly.

Ink spots may be removed from hardwood by applying spirits of nitre. When the surface turns white, clean it with a cloth. No trace of the ink will be seen after a few applications.

A solder that will fuse at a low temperature and used in uniting soft metals is made by adding 3 drops of mercury to each ounce of common solder.

Design for Frieze Border—From the London Decorator

Attaching New Concrete to Old

In a foundation or other structure where the strain is chiefly compressive, the surface of the concrete laid on the previous day should be cleaned and wet, but no other precaution is necessary. Joints in walls and other locations liable to tensile stress are coated with mortar, which should be richer in cement than the mortar in the concrete, proportions 1 to 2 being commonly used.

The adhesive strength of cement or concrete is much less than its cohesive strength, hence in building thin walls for a tank or other work which must be watertight, the only sure method is to lay the structure without joints. If the wall is to withstand water pressure and cannot be built without joints, both horizontal and vertical joints must be first thoroughly cleaned of all dirt and powdery scum, and then wet and covered with a very thin layer of neat cement or 1 to 1 mortar, according to the nature of the work. As an added precaution, one or more square or V-shaped sticks of timber, say 4 or 6 in. on the edge, may be embedded in the surface, or placed vertically at the end of a section, of the last mass of concrete laid each day, says The Concrete Review. In some instances, large stones have been partially embedded in the mass at night for doweling the new work next day. Roughing the surface after ramming or before placing the new layer will aid in bonding the old and the new concrete.

Twisting Square Bars in a Bolt Machine

The accompanying sketch shows the unusual product of a bolt-cutting machine. The material used was $\frac{5}{8}$-in. square wrought iron. One end of the bar was held in the jaws of the tap chuck, and the other end in the jaws for holding the pipe. After counting the revolutions of the spindle for the first piece, all succeeding pieces came the same by making the same number of turns, says the American Machinist.

Twisted in a Bolt Machine

The work was done cold, and no trouble experienced in making the twist uniform. The job is a good illustration of how a machine is often called upon to do something entirely different from that for which it is intended.

Place gold bronze in a ladle and heat it to a cherry red and a new copper bronze is obtained. Heat to a white heat for old copper. With a little practice in heating any shade may be obtained.

Telephone Troubles

Bell will not ring: Cause—Broken wire in bell box, line or ground wire, short circuit if bridging is metallic, or grounded if bridged lines.

Receives and transmits a ring feebly: Cause—Bad connections in bell box or poor ground, resistance cross if bridging metallic, resistance ground if bridged grounded line.

Rings other bells strong but its own bells weak: Cause—Ringer magnet weak or armature adjustment bad.

Rings other bells feebly but its own bells strong: Cause—Generator weak or armature adjustment bad.

Receives a ring but will not ring its own bells: Cause—Wire broken in generator or armature short circuited.

Rings but cannot talk: Cause—Broken cord, bad connection or hook does not go up to place, line open if bridged.

Can ring but can get no response: Cause—Line badly grounded or broken and grounded, if bridged line open.

Cannot ring or receive a ring: Cause—Wire broken in office or line, short circuit if bridged metallic, grounded if bridged to ground.

Bell rings frequently without apparent cause: Cause—Swinging cross with telegraph or other lines.

Receiver weak: Cause—Bad connections, diaphragm bent or dirty, position of diaphragm not correct (should be 1/32 in. from magnet), or permanent magnet weak.

Speech received is strong but transmitted is weak: Cause—Speaker stands too far from telephone or the battery is weak.

Speech indistinct with a bubbling, buzzing sound: Cause—Loose connection at microphone.

Spluttering or grating noise in telephone receiver: Cause—Loose connection at battery, transmitter or hook.

Can hear but cannot talk: Cause—Primary circuit open.

Two bells ring together or two switchboard-drops fall: Cause—Office wires or line wires crossed if on common return wire, return wire broken or annunciator ground broken.

Be sure batteries are properly connected and keep them in good condition, according to the instructions posted on them. Connect one battery wire with zinc pole of battery; the other with carbon pole of battery. In connecting two batteries together connect from carbon to zinc. Never connect carbon to carbon or zinc to zinc. Battery zinc must be kept clean and free from crystals and renewed if badly eaten. The battery cell should be free from crystallized sal ammoniac and the solution should reach the neck of the jar. Battery wire connections must be carefully guarded against corrosion.—Contributed by O. R. Clark, Rockford, Ill.

Quickly Made Sound Magnifier for Machine Lapping

When employing a power-actuated lap, the little instrument shown in the sketch is useful in determining the instant when the lap touches the work. By placing the forked end on the work

Sound Magnifier

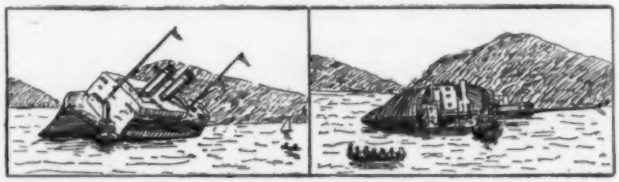
and the wooden part to the ear, the sound is greatly magnified, and it makes it much easier to determine the precise point of initial contact, says Machinery. If one depends upon the naked ear to tell when the lap touches the work, he is liable to crowd the lap too much, and scratch the work or strip the lap. With this instrument the mechanic will know the instant the lap just touches the work, and this is the position where its work should be done. In short, the lap should not work under any pressure, but should simply touch the work. This makes it desirable to have some means of magnifying the sound, instead of depending upon the naked ear.

ITALIAN VESSEL TURNS OVER WHEN LAUNCHED

Immediately following her first dip into the water the "Principessa Jolanda," the largest passenger ship ever launched in Italy, listed to port and slowly and silently disappeared from the sight of the startled thousands who had gathered from all parts of the Riviera to make the affair a "gala" event.

The vessel, 489 ft. in length, with a displacement of 12,000 tons, was built for the South American service. As the ship struck the water the immense hull keeled in an alarming manner, and gradually the flags and streamers, strung from mast to mast, swung lower and lower until in mortification they drowned their bright colors beneath the surface.

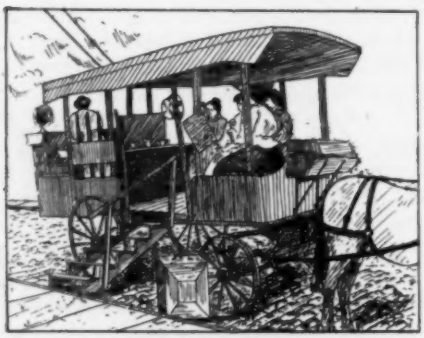
The accompanying illustrations show the vessel in the first stages of the disaster. When all was over nothing was left of the ship above water but a long stretch of black hull, 6 ft. out of water at the highest point.



From Two Photographs as the Ship Sank

PORTABLE ELECTRIC DEMONSTRATIONS

An interesting method of bringing the advantages of electric heating and cooking appliances before the public has been adopted by an electric light and power company in the central states. It is a demonstration wagon, fitted out with a complete line of cooking and work-saving electric utensils. A woman with pleasing appearance and manners has charge of the outfit.



Electric Cook Wagon

Each afternoon the wagon is driven to a different point along the route being canvassed and the woman demonstrator prepares to receive her guests. Cake, biscuit and coffee, made with the electric cooking utensils, are served, and the advantages of electricity for cooking explained. The day before the wagon is to arrive invitations are sent out, and usually most of the women in the neighborhood turn out and give the affair a social touch. Current is obtained from the service wires overhead.

INCANDESCENT LIGHTING WITH COAL OIL

In many country homes in Canada a lamp burner is being used which, screwed on to any ordinary coal oil lamp, produces its own gas from coal oil. This gas is burned on the ordinary incandescent gas mantle. The cost of lighting by this method is claimed to be only one-fourth of a cent an hour.

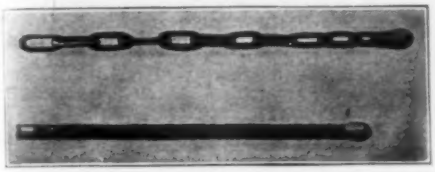
Oil-Gas Light

According to government experts less than 50 per cent of the average tree as it stands in the woods is brought to market as a product. The remainder is allowed to go to waste.

Amateur Mechanics

Novelty Chain Made from a Match

The accompanying engraving shows what is possible to do with a penknife. A small chain composed of several



Lay a Match on the Picture

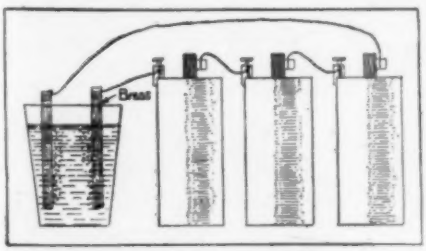
links was cut from the wood that forms the match.—Made by A. C. Courath, Marietta, Ohio.

An Interesting Electrical Experiment

Any one possessing a battery having an e. m. f. of from 4 to 20 volts can perform the following experiment, which is particularly interesting on account of the variation of results with apparently the same conditions.

Immerse two pieces of brass in a strong solution of common salt and water. Connect one piece to the positive wire and the other to the negative, taking care that the brass pieces do not touch each other.

After the current has passed one or two minutes, the solution will become colored, and if the process is continued a colored pigment will be precipitated. The color of the precipitant

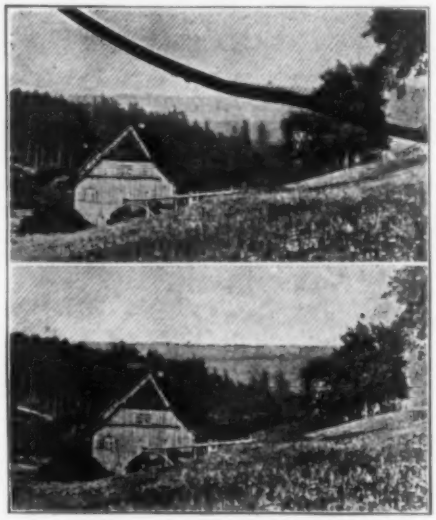


How Wires are Connected

varies considerably and may be either yellow, blue, orange, green or brown, and possibly others, depending on the strength of the current, the strength of the solution, and the composition of the brass.—Contributed by E. W. D., Chicago.

Restoring Broken Negatives

Whoever has the misfortune to break a valuable negative need not despair, for the damage can be repaired most effectively. In case the negative be broken into many pieces, take a



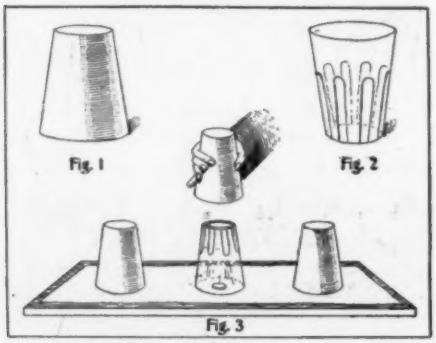
Before and After Mending

clean glass the same size as the broken negative, and put upon this the pieces, joining them accurately, says Camera Craft. Put another clean glass on top of this and bind the three together with passe-partout binding or gummed strips of ordinary paper, as one would a lantern slide, and cover the glass edges. Next make a transparency of this (in the camera, of course), and if done right the positive will only show the cracks as dark and light lines. The

dark lines are removed with the etching knife and the light ones with the retouching pencil. From this transparency another negative can be made, or as many negatives as necessary, by either contact or in the camera, and if the work on the glass positive was done carefully, no trace of the break should be seen on the finished negative. If the negative is broken in two or three larger pieces only, a contact positive may be made in the printing frame without binding, by using a clean glass in the latter, upon which the pieces are put together, face up, and a dry plate exposed in contact with them in the dark room. The accompanying engravings show a print before and after repairing a broken negative in this manner.

Coin and Tumbler Trick

The accompanying sketch shows how a good trick may be easily performed by any one. Lay a piece of



This is a Good Trick

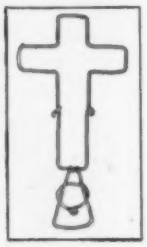
heavy paper that is free from creases on a board or table. Secure three tumblers that are alike and stick a piece of the same heavy paper over the openings in two of them, neatly trimming it all around the edges so as to leave nothing of the paper for any one to see. Make three covers of paper as shown in Fig. 1 to put over the tumblers. Place three coins on the sheet of paper, then the tumblers with covers on top of the coins, the unprepared tumbler being in the middle. Now lift the covers off the end tumblers, and you will see that the paper on the openings covers the coins. Replace the covers, lift the middle one, and a coin will be seen under the tumbler, as the opening of this tumbler is not covered. Drop the cover back again and lift the other tumblers and covers bodily, so that the spectators can see the coins, remarking at the same time that you can make them vanish from one to the other. The openings of the tumblers must never be exposed so that any one can see them, and a safe way to do this is to keep them level with the table.

Another Way to Renew Dry Batteries

There are many methods of renewing dry batteries, and I have used several of them, but I found the following the best: Remove the paper cover and with a ¼-in. drill make about six holes around the side of the zinc, about ½ in. from the bottom. Then drill another row of holes about half way up the side and put the battery to soak in a solution of sal ammoniac for 48 hours. Then remove and plug the holes up with hard soap, and replace in the paper box, when it will give nearly as strong a current as when new.

Simply Made Wire Puzzle

The object of this simply made wire puzzle is to get the ring off, which is not easy unless you know how. To do so it is necessary to move the triangle with ring to one of the hinge joints and fold the puzzle. Then slip the ring off the triangle over the hinge joint and it will slip all around and off at the other hinge.



Diabolo is pronounced Dee-ab-lo.

Two Boys Build an Automobile

The accompanying engravings show the completed work of twin boys, Wilford and Winfurd Goddard, 15 years of age. The boys started out with no other material than what they could collect around their own home. No suggestions were received by them and they designed and completed the work of building an automobile with the exception of the gasoline engine. This engine they purchased from their earnings. The automobile is about 8 ft. long, with a 40-in. tread. The driving arrangement from the engine to the rear axle is connected to a cone clutch, which in turn is connected to a chain drive. The wheels were made from large carriage wheels cut down to the proper size and fitted with 28-in. rims. The tires are standard bicycle tires with an extra cover. On a trial trip it carried four boys 6 miles, up and down hills and over sandy roads, at a speed of about 10 miles an hour.

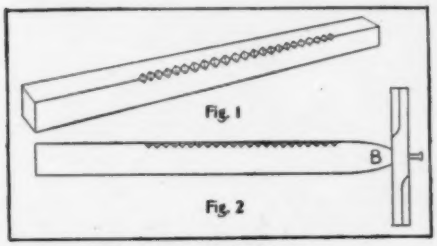
The Twins and Their Machine

A scientist has calculated that the eyelids of the average man open and shut no fewer than 4,000,000 times in the course of a single year of his existence.

Side View: Seat Removed to Show Construction

A Skidoo-Skidee Trick

In a recent issue of Popular Mechanics an article on "The Turning Card Puzzle" was described and illustrated. Outside of the scientific side involved, herein I describe a much better trick. About the time when the expression "skidoo" first began to be used I invented the following trick and



How to Cut the Notches

called it "Skidoo" and "Skidee," which created much merriment. Unless the trick is thoroughly understood, for some it will turn one way, for others the opposite way, while for others it will not revolve at all. One person whom I now recall became red in the face by shouting skidoo and skidee at it, but the thing would not move at all, and he finally from vexation threw the trick into the fire and a new one had to be made. Very few can make it turn both ways at will, and therein is the trick.

Take a piece of hardwood $\frac{3}{8}$ in. square and about 9 in. long. On one of the edges cut a series of notches as indicated in Fig. 1. Then slightly taper the end marked B until it is nicely rounded as shown in Fig. 2. Next make an arm of a two-arm windmill such as boys make. Make a hole through the center of this one arm. Enlarge the hole slightly, enough to allow a common pin to hold the arm to the end B and not interfere with the revolving arm. Two or three of these arms may have to be made before one is secured that is of the exact proportions to catch the vibrations right.

To operate the trick, grip the stick firmly in one hand, and with the forward and backward motion of the other allow the first finger to slide along the top edge, the second finger along the side, and the thumb nail will then vibrate along the notches, thus making the arm revolve in one direction. To make the arm revolve in the opposite direction—keep the hand moving all the time, so the observer will not detect the change which the hand makes—allow the first finger to slide along the top, as in the other movement, the thumb and second finger changing places: e. g., in the first movement you scratch the notches with the thumb nail while the hand is going from the body, and in the second movement you scratch the notches with the nail of the second finger when the hand is coming toward the body, thus producing two different vibrations. In order to make it work perfectly (?) you must of course say "skidoo" when you begin the first movement, and then, no matter how fast the little arm is revolving when changed to the second movement, you must say "skidee" and the arm will immediately stop and begin revolving in the opposite direction. By using the magic words the little arm will obey your commands instantly and your audience will be mystified. If any of your audience presume to dispute, or think they can do the same, let them try it. You will no doubt be accused of blowing or drawing in your breath, and many other things in order to make the arm operate. At least it is amusing. Try it and see.—Contributed by Charles Clement Bradley, Toledo, Ohio.

Radium acts upon the chemical constituents of glass, porcelain and paper, imparting to them a violet tinge; changes white phosphorus to yellow, oxygen to ozone, affects photograph plates and produces many other curious chemical changes.

On its official trial trip the British torpedo boat destroyer "Mohawk" attained the record speed of a little over 39 miles an hour.